ATTACHMENT B

Remote Transmitter/Receiver Facility (RTR) Communication Site Relocation Specs and Drawings

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AIR TRAFFIC ORGANIZATION

REMOTE TRANSMITTER/RECEIVER FACILITY (RTR)
COMMUNICATION SITE RELOCATION

PLANTS ENGINEERING TRANSMITTAL

PUEBLO (PUB) RTR
PUEBLO MEMORIAL AIRPORT
PUEBLO, COLORADO

FEBRUARY 2012

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SECTION 01000

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 Scope of Work - The work covered in these specifications and applicable drawings consists of furnishing all labor, tools, equipment, and materials necessary for the site work and plants construction associated with the FAA Remote Transmitter/Receiver (RTR) communications facility site relocation project at Pueblo Memorial Airport, Pueblo, Colorado. The following items are a brief summary of the project and are provided solely for the purpose of revealing the general nature of the work involved. The Contractor is responsible for accomplishing all items of work in accordance with the applicable drawings, specifications and provisions of the contract. Any sundry labor, materials, equipment not specifically detailed or specified, but required to complete the project, shall be provided by the Contractor as an integral part of the scope of work specified.

1.2 Major Items of Work

A. Construction of a reinforced concrete foundation to support a Government-furnished (GFM) 18-ft. x 22-ft. equipment shelter. Foundation design provided by FAA. Shelter to be installed on foundation by FAA/shelter vendor.

B. Construction of three separate reinforced concrete foundations to support three 25-ft. tall lattice-steel antenna towers (GFM). Foundation designs, anchor bolts, and bolt template provided by tower vendor/FAA.

C. Construction of ductbanks between the equipment shelter and each of the three antenna towers. Total combined length of three ductbanks approximately 300 LF, with two handholes per each ductbank. Installation of underground conduit from existing fiber optic manhole R1 to the shelter, approximate length 50 LF.

D. Construct Earth Electrode System (EES) around shelter foundation, tower foundations, and between towers and the shelter.

E. Trenching from existing Black Hills transformer to the new shelter and installation of 2 inch rigid conduit and 1/0 AWG wire from transformer to building meter. Approximate distance 150 LF.

F. Erection of three 25-ft. antenna towers (GFM) and secure to new foundations.

G. Equipping of each of the towers with fixtures, enclosures, lighting, lightning protection bonding & grounding, and Radian Safety Climb RAM Rail (GFM) ladder safety rail as specified.

H. Installation of 3 exterior enclosures (GFM) and interior overhead cable trays at new equipment shelter.

I. Installation of 7/8" Heliax cable (GFM) and electrical wiring between shelter and antenna tower platforms.

J. Installation of a single 24-strand fiber optic cable (GFM) in existing ductbank from Air Traffic Control Tower (ATCT) to MH-R1, and in new ductbank from MH-R1 to the new RTR shelter. Approximate total length 5700 ft.

K. Installation of lightning, grounding and bonding protection systems as detailed in section 16670 and on the drawings.

L. Site grading and application of geotextile fabric and gravel surfacing. Site dimensions 160-ft. x 160-ft. Construction of gravel driveway, approximate 100-ft. length, to connect the site with adjacent unpaved airport access road. Reference site drawings.

1.3 Applicable Publications: - The current Federal, Commercial and Trade Association Publications, as listed in the separate sections, form a part of this specification to the extent applicable to the work being specified. Where materials or workmanship are required by this contract to exceed the referenced code or standard, it is the contractor's responsibility to provide materials or workmanship that exceeds the referenced code or standard. Such publications are initially listed by basic designation and subject matter title but will be referred to thereafter in the technical provisions by basic designation only. The federal agencies, Commercial, and Trade Associations referenced in these specifications are as follows.

A. American Society for Testing and Materials. (ASTM) - Information on obtaining copies of ASTM Standards may be obtained from The American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, (215)299-5400.

B. Federal Specifications – Copies of Federal Specifications are available for Global Engineering Office, 2625 Hickory Street, P.O. Box 2504, Santa Ana, CA 91707, Tel. (714) 540-9870 or (800) 854-7179.

C. Occupational Safety and Health Administration - Information on obtaining copies of OSHA regulations may be obtained from the U.S. Department of Labor,

Occupational Safety and Health Administration, 1111 Third Avenue, Suite 715, Seattle, Washington, 98101-3213, Tel. (206) 553-5930.

D. National Fire Protection Association (NFPA) - Copies of the National Electrical Code (NEC) and the Lighting Protection Code may be obtained for the National Fire Protection Association, 1 Battery March Park, P. O. Box 9101, Quincy, MA 02269, Tel. (800) 344-3555.

E. National Electrical Manufacturers Association (NEMA) - Information on obtaining copies of NEMA standards may be obtained from the National Electrical Manufacturers Association, 2101 L Street NW, Washington, DC 20037, Tel. (202) 457-8400.

F. Underwriters' Laboratories, Inc. (UL) - Copies of UL publication may be obtained from Underwriter's Laboratories, Inc., Publications Department, 333 Pfingsten Road, Northbrook, IL 60062, Tel. (708) 272-8800.

G. FAA Standards - Copies of FAA Standards are available from the Federal Aviation Administration, Northwest Mountain regional Office Supply Center, 1601 Lind Avenue SW., Renton, WA 98055-4056, Tel. (206) 227-2843.

H. Insulated Cable Engineers Associations (ICEA) - Information on obtaining copies of the ICEA publications may be obtained from the National Electrical Association, 2101 L Street NW, Washington DC, Tel. (202) 457-8400.

1.4 Safety

A. Contractor Safety Plan - No construction shall begin until the Contractor's Safety Plan is submitted to the government for review and approval by the Engineering Services Safety Engineer. The Safety Plan shall identify and address those federal and local requirements applicable to the required work. The Safety Plan shall also include employee training certifications, and address hazard assessment planning (29 CFR 1926.21), including plans for fall protection (29 CFR 1926.502 / 29 CFR 1926 Subpart M), ladder safety, rescue plan, falling objects guidance (29 CFR 1910.135 / 29 CFR 1926.759), welding/hot work, and hearing protection. All work should be conducted with de-energized equipment, but if equipment is to be energized for any reason, an energized work permit must be submitted with the Safety Plan, as well as plans for arc flash, and lock out tag out.

B. Safety Response - A map with directions to the nearest hospital is to be incorporated into the contractor's safety plan along with emergency contact information, including rescue services.

C. MSDS for any hazardous chemicals/materials used during the project must be kept at the job site. OSHA CFR 1926.59 and 1910.1200, FAA 3900.19B Chp. 19.

D. The contractor shall comply with all applicable Federal, State and local safety and environmental regulations, and requirements, including but not limited to Occupational Safety and Health Act (OSHA)(29 CFR 1910 and 29 CFR 1926), NFPA and EPA guidance. The contractor is responsible for ensuring that employees utilize necessary PPE (29 CFR 1910.254 / 29 CFR 1926.1053), and for providing safe and healthful working conditions on site for its employees, sub-contractors, suppliers and any others who may be within the work area. See Appendix for attached Safety & Health Checklist.

1.5 Facility Operation

A. The FAA will occupy the Mobile Communication Van (MCV), located immediately adjacent to the project site, during the entire period of construction. The facility contains critical FAA equipment. This equipment must remain in service during this project. It is imperative the Contractor maintain power service and access to these facilities. No interruption in service of FAA equipment will be permitted without an approved facility outage.

B. Unplanned outages, due to construction activities, pose a significant risk to the FAA Air Traffic Control System and to aircraft in flight. Unplanned outages must be avoided.

C. Cooperate with the FAA to minimize conflict, and to facilitate FAA operations. The contractor shall obtain clearance from resident engineer (RE) prior to disconnecting cables or working on any similar service item.

1.6 Protection of Existing Facilities and Utilities

A. Utilities and Cables

1. Protection of existing Utilities and Cables- The existing utility lines, structures and all underground cables, as may be shown on the drawing are approximate. Where excavation occurs in the vicinity of existing utilities or cables, the contractor shall use whatever means necessary, including a cable locator, to locate the existing utilities or cables prior to any excavation. If the Utilities are located within five feet of the building, the contractor shall hand excavate.
2. The Contractor shall stake all utility or cable crossings and such areas shall be hand excavated within five feet of located existing buried cables. The Contractor shall immediately repair any damage done by the Contractor, sub

contractor or suppliers to any utilities or cable not subject to demolition. In the event that the Contractor damages any existing lines that are not shown on the drawing or the locations of which are not known to the Contractor, report thereof shall be made in writing immediately to the Contracting Officer's representative.

3. If the utility lines are encountered within the area of operations, the Contractor shall notify the COTR immediately so that the necessary measures may be taken to prevent interruption of the service.

B. Protecting Government Property - The Contractor shall take all precautions necessary to protect the existing facilities, equipment, buildings, vegetation, etc., during construction. Any damage done by the Contractor or any subcontractors shall be repaired or replaced by the Contractor at no additional cost. Repairs shall be approved by the resident engineer and shall match the original finish. The Contractor shall provide all temporary covers, enclosures, barricades, etc., required to protect the existing facilities.

1.7 Use of Facilities: - Contractor shall provide at his/her expense all necessary water, electric, communications, and sanitary facilities required for the entire duration of the construction period.

1.7.1 Temporary Toilets and Sanitation: - The Contractor shall provide ample and suitable onsite sanitary conveniences with proper enclosures for the use of the workers and other personnel employed at each site. Such conveniences shall be kept clean, properly ventilated, installed, and maintained in conformity with requirements of all laws and ordinances governing each installation. Locations shall be subject to the resident engineer's approval. After completion of the work such conveniences shall be removed from the site.

1.8 Work on Airports - The Contractor shall comply with all special regulations as required by the Airport Manager, including Pueblo Airport Contractor badging for all workers. The contractor must coordinate with the Resident Engineer and airport management prior to entering the restricted area and before leaving the work site each day. The contractor must obtain approval for the locations and heights of all material to be stockpiled in the restricted area. The contractor shall be familiar with airport regulations and account for all costs necessary to comply with these regulations in his/her contract bid.

1.9 Airport Badging – Each contractor employee needing access to the job site will be required to obtain an airport contractor's badge. The badge cost is $10 each and can be obtained by first viewing training videos, and passing an STA background check, which typically takes approximately one day to complete.

1.10 Insurance – As required by airport management.

1.11 Permits - The Contractor shall be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, county and Municipal laws, codes and regulations applicable to the performance of this work.

1.12 Cleanup and Waste Disposal – The work site shall be kept clean and orderly during the progress of this project. Waste materials and debris shall be cleaned up and removed from the site at the end of each workday. No loose items may be stored on the site. The Contractor shall provide on-site containers for the collection of waste materials, debris and rubbish and periodically remove the aforementioned materials from the site. All waste shall be disposed of off-site and in compliance with local regulations. All waste electrical equipment shall be recycled by an FAA approved recycling company. The Contractor is responsible for any hazards caused by construction debris.

1.13 Contractor's Warranty: - The Contractor shall provide a signed, written warranty that all materials and/or workmanship under this contract are guaranteed against defects or incorrect installation for a period of one year after completion of work. Repair and/or replacement of any defective materials, improper workmanship, and/or items not in accordance with the plans and specifications shall be at the Contractor's expense.

PART 2 MATERIALS

2.1 Contractor Supplied Materials – The Contractor shall furnish all materials not specifically listed as Government Furnished Materials (GFM). Materials and equipment supplied must comply with all contract requirements. Materials furnished by the Contractor shall be new, the standard products of manufacturers regularly engaged in the production of such materials and of the manufacturer's latest designs that comply with specifications. Materials provided shall bear the label of the Underwriter's Laboratory (UL) if those materials are normally evaluated and labeled by UL.

2.2 Government Furnished Materials – The Government will furnish the following materials:

- Lattice-steel 25-ft. antenna towers, with anchor bolts and templates.
- 18-ft x 22-ft equipment shelter.
- Foundation designs for shelter and tower foundations.
- Radian Safety Climb RAM Rail system for Installation on each tower.
- 7/8" Heliax cable and 24-strand fiber optic cable.
- NEMA 4X enclosures, 2-ea. 24x24x8 for each tower platform, and 3 total 36Hx48Wx12D for the shelter.
- L-810 LED Obstruction light assemblies for each tower.

2.2.2 Inspection of Government Furnished Materials – The Contractor shall inspect the Government Furnished Materials in the presence of the Resident Engineer. Any defects that are observed shall be recorded including scratches in paint and small dents and dings. An inventory of the various item and quantity of each item shall be recorded, dated and signed by both the Contractor's Representative and the Resident Engineer.

2.3 Care of Government Furnished Materials – The Contractor is responsible for the care of all items on the inventory until they have been incorporated into the work or returned to the FAA if they are not needed to complete the work. The cost of repair or replacement for damaged or broken items will deducted from the contract payment. The contractor shall be responsible for disposal of any surplus Heliax or Fiber Optic cable, and the shipping reels, unless the FAA agrees to keep possession of the material.

*** * * END OF SECTION * * ***

SECTION 01041

PROJECT COORDINATION

PART 1 GENERAL

1.1 Schedules

A. Project Schedule:

1. The following are important dates for completion of several major activities in the project. Achievement of these goals is necessary to ensure that the new RTR facility can be placed in service in September, 2012. The sequence of construction activities will for the most part be driven by these dates:

    - July 2, 2012 – Shelter foundation ready to receive shelter.
    - July 9 – Shelter counterpoise (EES) complete, AC power available.
    - August 1 – Fiber optic ductbank complete from MH R1 to shelter.
    - August 15 – Tower #1 completed and ready for service. Cable tray installed inside shelter.
    - August 31 – Towers #2 and #3 complete and ready for service.
    - September 7 – All work complete.

2. Contract time is 15 calendar days for the submittal phase and 95 calendar days for the construction phase. During the submittal phase, the contractor shall order all materials and have their employees badged and trained.

3. The Contractor shall submit a project schedule with his/her bid. The schedule shall contain start and completion dates for all major items of work as well as the overall project. The schedule shall provide for two phases: 1) Submittals/Material Acquisition and 2) Construction.

B. Hours of Work: Work hours shall not exceed 50 hours per week and all shall be between 7:00am and 5:30pm Monday through Friday. No work will be performed on weekends or Federal holidays. The contractor shall coordinate in advance all work hours with the resident engineer. The contractor will not be allowed access to or to work at the site without the resident engineer.

C. Preconstruction Conference: As soon as practicable after the contract is awarded a preconstruction conference between representatives of the FAA and the Contractor will be scheduled. Project requirements, scope and schedule will be discussed.

1.2 Coordination

A. All work shall be coordinated with the FAA, the Airport staff and any other users/customers/government agencies which may have interest.

B. There are no utility outages scheduled for this project.

1.3 Contract Administration

A. The Resident Engineer (RE) shall be the FAA's onsite representative for all matters relating to the technical requirements of the project. Coordinate all communication through the RE.

B. The contractor shall complete a Request for Information form for all questions regarding this contract. The completed form shall be presented to the resident engineer who will coordinate with the FAA project engineer for an official FAA written response. This written response will be binding to the contract. The contractor will encounter numerous individuals with different levels of responsibilities and different levels of authority. No one, except for the FAA contracting officer, has the authority to modify this contract – either verbally or in writing.

C. Due to the possibility of miscommunications, verbal conversations between the contractor and resident engineer will not obligate the government or serve to modify contract requirements.

1.4 Inspection

A. The Resident Engineer and/or Contracting Officer's Representative (COR) will inspect all work in progress up to completion and final acceptance including workmanship and all materials, tools, and equipment.

B. Inspection may extend to all or a part of the work for the preparation, fabrication or manufacture of the materials to be used.

C. The Resident Engineer and/or Contracting Officer's Representative (COR) will notify the Contractor of any non-compliance with the contract specifications and/or drawings, and may reject workmanship or materials accordingly.

1.5 Close Out

A. Notify the RE when work is considered ready for Substantial Completion. A Construction Acceptance Inspection (CAI) will then be scheduled. The CAI shall be attended by the RE, FAA Project Engineer, the FAA Site Technician (from the local SSC), the Contractor and any appropriate sub-contractors.

B. All requirements of the contract shall be completed and ready for inspection at the time of the CAI. Each individual site will be subject to a CAI as they are completed.

C. Complete all punch-list items from the CAI.

D. Provide final submittals.

E. Submit final Application for Payment following the CAI and acceptance of submittals.

F. Final Clean up.

1. Execute final clean-up prior to the CAI.

2. Remove waste and surplus materials, rubbish, and construction facilities from the site. All waste electrical equipment shall be recycled by an FAA approved recycling company.

PART 2 MATERIALS

Not Used.

PART 3 EXECUTION

Not Used.

*****END OF SECTION*****

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 Submittal Requirements. - Submittal data required by this contract shall be submitted to the FAA Project Engineer for review and approval. All submittals shall be provided within 10 working days after the notice to proceed. Unless directed otherwise by the FAA, the contractor shall not proceed with any construction work until after approval of all submittals.

1.2 Submittal Procedure –

1.2.1 Three complete sets (to include one reproducible) of all shop drawings and/or product data shall be submitted by the contractor. One stamped set will be returned to the contractor.
The shop drawings must be either electronically generated or hand drawn to scale on a size D sheet and conform to FAA drafting standards FAA-STD-002e. Hand sketch submittal drawings (not to scale) will NOT be accepted by the FAA.

1.2.2 All submittals shall be accompanied by a transmittal letter which identifies the item and the data submitted, notes any substitutions or deviations from the specifications and contains the prime contractor's approval signature. Transmittal letters shall consist of one original and one copy.

1.2.3 All submittals, including those from subcontractors, shall be checked and approved by the subcontractor and coordinated with any other work involved before they are transmitted for review and approval. Submittals shall be complete and detailed, and assembled in sets. Lack of completeness or inadequate descriptions will be justification for disapproval.

1.2.4 The FAA requires five (5) working days for reviewing and responding to each submittal. The contractor shall account for this review period during this contract.

1.3 Submittal Review – The FAA will stamp, check the review status, sign and date each submittal page. The contractor shall address the review status as follows:

1.3.1 Approved As Submitted – If stamped and checked "No Exception Taken," the submittal is approved. After submittals have been approved, no changes or substitution will be permitted without written approval from Parsons.

1.3.2 Approved As Noted - If stamped and checked "Make Corrections Noted," the submittal is satisfactory contingent upon the Contractor's acceptance of the comments and notations; no re-submittal is required. If not accepted, the contractor must resubmit.

1.3.3 Not Approved - If stamped and checked "Revise and Resubmit" or "Rejected," the submittal does not meet job requirements and the contractor must resubmit. The contractor shall resubmit the corrected material in the same manner as the original.

**** * END OF SECTION * * ***

SECTION 02070

SITE WORK

PART 1 GENERAL

1.1 Description: Work includes locating underground utilities and the demolition and removal of any underground debris not designated to remain. Work also includes restoration of disturbed off-pavement areas, i.e. raking and soil preparation.

1.2 Underground Utilities and Other Debris:

A. Demolition: Upon approval of the R.E./COTR, the Contractor shall demolish and remove any existing, abandoned underground utility or debris as necessary for the construction of the new communications ductbank. All reasonable efforts, including utility locates and potholing shall be completed in order to identify existing utilities.

B. Protection:

1. The Contractor shall protect the existing buried electric line from the North that connects to the transformer at the mid-point of the North site boundary, and branches east to service the FAA Mobile Communications Van (MCV).
2. The Contractor shall protect the existing fiber optic ductbank to the East of the site that terminates at Manhole R1, which is located approximately 50 feet east of the center point of the site.

1.4 Vegetation & Other: The Contractor shall remove and dispose of vegetation as necessary for the construction of the new structures and ductbanks.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

3.1 Asbestos-Suspected Materials – N/A

3.2 Protection

A. Demolition and removals shall be performed with care so as to create the least possible damage to the supporting and surrounding surfaces. Damaged surfaces shall be repaired or restored to their original condition.

B. Perform demolition in such a manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, structures or services; and to provide free passage to and from such adjacent areas. Comply with OHSA requirements.

C. Provide safeguards, such as cones, barricades, signs and other similar items that are required for the protection of all personnel during demolition and removal operations.

D. Provide and maintain safeguards, such as barricades, cones, etc. around excavations until such excavations have been completely filled.

E. Prevent the spread of flying particles and debris outside of the planned work area. Keep the work area cleaned on a daily basis.

F. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. All workers shall be instructed in the use of fire extinguishers. Fire watch is required for 30 minutes after any cutting or welding.

3.3 Disposal:

A. All materials and debris resulting from the demolition shall be disposed of offsite and in accordance with General Requirements and the applicable federal, state and local codes. All waste electrical equipment shall be recycled by an approved recycling company.

3.4 Utilities: If utility lines are encountered that are not shown on the drawings, contact the resident engineer for a determination of its use. If the line is abandoned the contractor shall remove sections as necessary for the completion of the ductbank construction and plug or cap the ends. If the line is in service, the contractor shall complete the ductbank construction with the required utility crossing detail as shown on drawings.

3.5 Removal of Vegetation: Remove vegetation as necessary for grading/excavation and dispose of off-site in an approved area. Fill resulting holes with native materials and provide a smooth transition with the surrounding area. Control erosion until area stabilizes.

3.9 Disposal and Cleanup:

A. All unneeded materials and debris resulting from the construction shall be disposed of offsite and in accordance with the General Requirements and the applicable federal, state, and local codes.
B. Do not allow accumulations to remain overnight on the ground or pavements. Store all waste that cannot be removed daily in an enclosed, metal container. Burning will not be permitted.

*****END OF SECTION*****

SECTION 02300

EARTHWORK

1.0 GENERAL REQUIREMENTS

1.1 Scope - The Subcontractor shall perform and complete all work as necessary for site preparation, excavation, borrow, fill, backfilling, compacting, grading, geotextile and gravel surfacing (entire site and driveway) necessary to construct the finished grades indicated for each plot area and cable trench specified herein and as shown on the project drawings. Soil compaction tests are required for the foundation gravel.

1.2 Site Boundary – The site boundary is shown on the drawings. The Subcontractor shall verify the location with the site drawings. The Subcontractor shall maintain all established control points as required to ensure the accuracy of the work.

1.3 Applicable Publications - The latest edition in effect of the following publications form a part of this specification and are applicable to the extent specified herein.

1.3.1 American Society for Testing and Materials (ASTM) Publications:

C 136	Sieve Analysis of Fine and Course Aggregates
D 698	Moisture-Density Relations of Soils and Soil Aggregate Mixtures
D 1140	Amount of Material in Soils Finer Than the No. 200 Sieve
D 1556	Density of Soil in Place by Sand Cone Method
D 1785	Polyvinyl Chloride (PVC) Plastic Pipe Schedules 40, 80 and 120
D 2487	Classification of Soils for Engineering Purposes
D 2564	Solvent Cement for PVC Plastic Pipe and Fittings
D 2937	Density of Soil in Place by Drive Cylinder Method
D 2922	Density of Soil and Soil Aggregate in Place by Nuclear Methods
D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.4 Site Conditions

1.4.1 Classification – Existing material is unclassified and site conditions appear to be such that all trenching and excavating can be accomplished without ripping or blasting.

1.4.2 Freezing - When freezing weather is expected, excavations shall not be made to the full depth, unless backfill or concrete can be placed immediately. If the excavation is already at full depth, the excavation shall be protected from frost.

1.4.3 Drainage - Excavation shall be performed so that the area of excavation and the area surrounding the excavation will be continually and effectively drained. Water shall not be permitted to accumulate in excavations. The excavations shall be drained by

pumping or other satisfactory methods to prevent softening of the foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures. Any water from pumping shall be disposed of well away from any sensitive areas such as wetland areas. If the water disposal site is on airport property, the Subcontractor shall have prior approval of the location from the RE.

1.4.4 Erosion Control – The Subcontractor shall take steps as necessary, to prevent damage from erosion during and following completion of the work.

1.4.5 Dewatering – Plan for and provide equipment to collect and dispose of any standing water in excavations prior to placing concrete or backfill.

2.0 MATERIALS

2.1 Soil Materials suitable for fill, backfill, and embankment purposes shall be free of shale, sod, clods and stones larger than 4 inches, organic debris, trash, and frozen material. Only material suitable for obtaining the degree of compaction specified herein shall be used. Excavated soil is expected to be suitable for backfill. All backfill material, including utility trench and foundation backfill, shall be compacted while at a moisture content near optimum and to a dry density that is not less than the specified percentage of the maximum dry density as determined by ASTM D-698.

2.2 Trench Backfill

2.2.1 Sand Bed – Material for the bottom of the trench shall be natural sand or select sandy material with no particles larger than ¼-inch.

2.2.2 Initial Backfill – Material for the first layer of trench backfill above the sand bedding shall be imported or select excavated material containing no particles larger than 1-inch.

2.2.3 General Trench Backfill – The remainder of the trench backfill shall consist of excavated materials excluding stones larger than 4 inches.

2.3 Crushed Stone Surface Material – State Spec. 1-1/4" Crushed Surfacing Base Course (CSBC)

2.3.1 Pit Run Gravel Material for Foundations – Pit Run- ISPWC, Section 801 – 6" minus soil and rock. Percentages are by weight.

SIEVE SIZE	PERCENT PASSING
6"	100%
#4	15-60%
200	0-12%

2.4 Warning Tape – Shall be the appropriate color for the item buried and shall be 6-inches wide, 6 mil minimum thickness permanently imprinted with the appropriate legend, and located to the dimensions as shown on the drawings.

2.5.1 Non-Metallic Conduit – Polyvinyl Chloride (PVC) conduit shall be Schedule 40, heavy all-rigid plastic with fittings and accessories designed for direct burial and shall conform to ASTM D 1785 and shall be UL listed. Any exposed PVC conduit shall be sunlight resistant.

2.6 Galvanized Rigid Steel Conduit – Shall comply with ASTM A 501, hot-dipped galvanized. All fittings shall be threaded and all connectors shall include insulated bushings. For underground installation the conduit shall be factory coated with 0.063-inch thickness of coal tar enamel or shall be field-wrapped with 0.01-inch thick pipe wrapping plastic tape designed for this purpose and applied with a 50 percent overlap.

3.0 EXECUTION

3.1 Preparation

3.1.1 Protection of Underground Utilities.

1. All existing underground utilities depicted on the drawings, (which include but are not limited to: power, control, and communications cables; telephone, water and sewer lines; and other utilities) are shown in their approximate locations only. Other utility lines may exist but not be depicted. It is the Subcontractor's responsibility to assure that locations of all underground airport, FAA, public, and/or private utilities are established prior to work in the area.
2. The Subcontractor shall at its expense satisfactorily repair and/or pay the cost of repair for all damages to underground utilities that result from the Subcontractor's or its lower tier subcontractors' operations during the period of the Subcontract. The Subcontractor is responsible for completing any required repair work to any underground utility that is damaged by its workers, equipment, work, or subcontractors immediately, and with equal material approved by the RE.
3. If the Subcontractor damages a cable that has been previously located, then the Subcontractor shall be required to repair the cable and, at its expense, install either a pull box or manhole depending on the type and/or size of the cable. The RE shall determine whether a pull box or manhole is required. All costs related to the repair of the damaged cable shall be the responsibility of the Subcontractor.
4. Do not interrupt existing utilities serving facilities occupied by the Government or others except when permitted in writing by the RE and then only after acceptable temporary utility services have been provided. Provide a minimum 48-hours notice to the RE. Do not proceed with the interruption of any utility without written notice from the RE.

5. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
6. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.
7. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties.

3.1.2. Pre-excavation Requirements for Underground Utility Installations.

1. Prior to any excavation, the Subcontractor shall layout in the field the centerline of all proposed utilities. In addition the Subcontractor shall white line (by white spray paint or other means acceptable to the RE) the limits of construction including the area(s) to be excavated. The Subcontractor shall also identify the proposed placement of grounding rods and cathodic protection.
2. The Subcontractor shall identify the location of existing underground utilities on as-built drawings, including any unknown or abandoned utility found during construction. The Subcontractor shall ensure that all Airport officials, FAA technicians, other utility owners/operators, and any One-Call System performing utility designation/location services designate/mark existing utilities within the construction limits as well as the entire path of excavation, including five feet to either side of proposed utilities. The Subcontractor shall be solely responsible for notifying relevant utility owners/operators and One-Call System sufficiently in advance to ensure that delays to construction do not occur.
3. After completion of the utility designation described above, the Subcontractor shall hire a professional Subsurface Utility Engineering (SUE) or utility designation/locating company, acceptable to the RE, to designate and sweep the entire excavation area, including five feet to either side of proposed utilities, to confirm the locations of the marked utilities and identify and mark any additional unidentified utilities that may be within the limits of excavation.
4. The Subcontractor shall notify the RE of the preferred date and time for a pre-work meeting for all excavation work. The RE will coordinate the pre-work meeting with utility owners, local Airport Authority, FAA, the Subcontractor, and others as applicable to walk the excavation area and review applicable documentation. The subcontractor shall arrange to have its excavator and SUE (or designation firm) at the pre-work meeting. The Subcontractor shall provide a written excavation work plan acceptable to the RE that includes a contingency plan to restore to service all utilities including cables that may be placed out of service or damaged during performance of the work. The work plan at a minimum shall include:
    a. A list of qualified subcontractors such as plumber, electrician, fiber optical cable splicer, and others as applicable for emergency repair purposes. Due to current FAA/TSA/Airport security requirements, the Subcontractor shall ensure that

these subcontractors have passed any airport security and registration requirement so they can be presented immediately at the job site when emergency repair is warranted.

b. The Subcontractor shall coordinate with the RE to request an Emergency Procedures Plan from the Airport Authority or facility manager. This plan will outline special procedures during emergencies, disasters, accidents and injuries. The Subcontractor is to review the Emergency Procedures Plan with all its personnel prior to construction and every quarter thereafter.

c. The Subcontractor shall investigate and provide a list of sketches/drawings to all disconnects to electrical circuits, jet fuel lines, natural gas, and main water sources that feed the services in the project area and its vicinity. All disconnects and shut-off valves shall be noted with special notation and procedures if required by the utility owners/operators.

d. Name of the SUE or utility designation firm including training and experience of the technician who will be performing the utility designation as well as equipment that will be used for sweeping the area to be excavated.

e. Name of the excavator including training and experience of the equipment operator who will be doing the work.

5. Subcontractor shall expose all utilities that it will be crossing through non-destructive mechanical excavation methods such as vacuum excavation or similar mechanical method(s) approved by the RE ("potholing") or by hand digging. When a cable is located, the Subcontractor shall hand-excavate a trench five (5) feet each side of the exposed cable to verify that another cable is not adjacent to the exposed cable. All critical or high priority facilities shall be exposed by potholing or hand digging every 100 feet (or less if on a curve) if the Subcontractor is working on or parallel to a critical or high priority utility. All exposed utilities shall be properly supported and protected during construction.

6. Subcontractor shall continuously maintain utilities, facilities and/or systems that are or may be affected by work associated with the project. The Subcontractor shall provide the RE with written reports on any cable cuts.

7. If the Subcontractor does not find an underground utility that was previously marked, the excavation shall be stopped, the RE shall be notified, and the Subcontractor shall contact the appropriate owner/operator of the utility or make contact with the appropriate owner/operator, using the One-Call System when warranted.

8. Every attempt shall be made to preserve the locate markings during excavation. Locate markings that are no longer visible shall be refreshed by calling the one-call system and/or the utility owners/operators for remarking.

9. All existing utilities that have been exposed during exploratory potholing or excavation must be supported to prevent stretching, kinking, or damage to the existing utility.

3.2 Excavation

3.2.1 General - Excavation shall be to the contours and dimensions indicated on the drawings. Notify the RE and Subcontract Administrator immediately in writing in the event that it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated in order for any adjustment in subcontract price to be considered. Excavations cut below the depths indicated shall, unless otherwise specified, be backfilled with fill or granular fill and be compacted in a manner acceptable to the RE.

3.2.2 Inspection - When excavations have reached the required dimensions and elevations, the Subcontractor shall notify the RE for inspection and approval. No concrete or other permanent part of the structure may be placed until the RE has given permission to proceed.

3.2.3. Subcontractor's Observer - An observer, acceptable to the RE, shall be present to assist the equipment operator when operating equipment around known underground facilities and utilities. Adhere to the following during excavation:

1. All mechanized excavation shall start with 6 to 10 inches excavation on the surface. The equipment operator shall immediately cease operation and notify the RE if utility warning tapes, sand, or bedding material is uncovered at any time during excavation.
2. All excavations within 5 feet of any pedestal, closure, riser guard, pole (with riser), meter, or other structure shall be performed by hand digging or other means such as vacuum excavating.
3. If the Subcontractor discovers damage, causes damage, or even contacts an existing underground utility, the owner/operator of that utility, and RE shall be notified immediately. The Subcontractor shall be responsible for making necessary repair and/or replacement in accordance with this section and the terms and conditions of the Subcontract.
4. If there is a critical or high priority utility line in the dig area, make arrangements for the utility owner/operator to be on the job site during the excavation. If the utility owner/operator refuses to be present, document this response by appending it to the request form.
5. Only those subcontractor employees qualified by training, licensed or experienced (as appropriate) shall be permitted to operate machinery, tools or equipment.
6. The Subcontractor and RE shall coordinate on a daily basis with the excavator regarding the work to be performed that day with an emphasis on the excavation work plan and anticipated utility crossings.

3.2.4 Accidents - In case of an accident and/or damage to an existing utility, the Subcontractor shall:

1. Immediately contact the RE and Airport Emergency Services or facility manager in the case evacuation is required. Follow the Emergency Procedures Plan.
2. Immediately report all damages, including kinking or sheath damage to the RE. Notify facility owner or operator as directed by the RE.

3. Repair any damages and complete the Damage Investigation Report in accordance with Section 00840 and the Subcontractor's Site Specific Safety Plan, and submit to the RE. Pictures shall be taken and attached to the report to help document the damage.
4. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.2.5 Safeguarding Existing Utilities and Conditions - Preserve, protect and maintain existing operable drains, sewers, and electrical ducts during grading, excavating and backfilling operations. Keep excavations dry. Locations indicated for existing utility facilities are approximate. Pipes or other manmade obstructions, in addition to those indicated, may be encountered. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Subcontractor's risk. Perform all work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility owner. Excavation made with power driven equipment is not permitted within five feet of any known existing utility. Start hand excavation on each side of the indicated obstruction and continue the obstruction is uncovered. Support uncovered lines until approval for backfill is granted by the RE. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.2.6 Control of Surface and Subsurface Water - Plan for and provide the equipment and construction for the collection and disposal of surface and subsurface water encountered in the course of construction. Excavation shall be performed so that the area of the site and the area immediately surrounding the site and affecting operations at the site will be continually and effectively drained. Water shall not be permitted to accumulate in the excavation. Surface water shall be diverted from excavations by means of temporary drainage facilities. Subsurface water that interferes with excavation, backfill or construction shall be controlled and disposed of as necessary. The excavation shall be drained by pumping or other satisfactory methods to prevent softening of the foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures.

3.2.7 Trench Excavation - Excavate trenches to indicated slopes, lines, depths, and invert elevations.

1. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated. The banks need not be kept vertical but may be sloped provided there is no interference with other utilities. The trench bottom shall be a minimum of 12 inches wide or as required to provide required clearance.
2. Clearance: Optimum 6 inches (300 mm) each side of pipe or conduit with minimum 12-inch separation between power and control cables or between power cables of different voltages.

3. The depth of the trench shall be 4 inches below the conduit. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
4. All conduit requires a minimum of 24 inches of cover from finished grade.
5. Trenches shall be opened only to the extent that conduit or cables can be installed and the trench closed during the same working day.

3.2.8 Foundation Excavations - Foundation excavations shall be accomplished to allow sufficient clearance for placing and removing forms, installing services, and inspection. Subgrade soils shall be protected from the elements and from the action of repetitive loading. Upon completing any foundation excavation, the subcontractor shall notify the RE. No concrete or other permanent part of the structure may be placed until the RE has given permission to proceed. The Subcontractor shall remove all loose material just before placing concrete. Concrete placement shall begin no later than twenty-four (24) hours after completion of the excavation. Backfill and compact over excavations to 95 percent of ASTM D698 maximum density.

3.2.9 Rock Excavation - In the event that rock is encountered, all material shall be removed to a depth 6 inches below the bottom of the excavation grade and replaced with satisfactory fill material. If foundation excavation reveals solid rock at the bottom of the excavation grade and no potentially faulty bearing surfaces, such as soil or crumbling rock, are apparent by visual inspection, excavation shall penetrate it at least one foot, or more if the plans require, to form a key for the footing. The Subcontractor shall cut the bottom of the excavation to a firm surface, level, stepped, or serrated as the RE directs, and remove all loose material. If concrete will rest on any excavated surface other than solid rock, the Subcontractor shall not disturb the bottom of the excavation. No footings shall be permitted to rest partly on soil and partly on rock. In the event that excavation reveals potential foundation-bearing surfaces of part rock and part soil, the Subcontractor shall remove the soil and fill the voids with concrete.

3.2.10 Stockpiling of Materials - Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust. Stockpile soil materials away from edge of excavations.

3.3 Backfill

3.3.1 General

1. Prior to backfilling, the owners/operators of existing facilities/utilities that were exposed during potholing or excavation shall be contacted and given the opportunity to inspect for damage that may have occurred during the excavation process. All responses and inspections shall be documented.
2. The Subcontractor shall take care not to damage existing facilities and utilities during backfill and compaction.
3. All material used to backfill potholed or excavated existing utilities shall be clean and free of large rocks, sharp objects, and large chunks of hard-packed dirt or clay. The utility owner/operators shall be contacted for additional requirements regarding their utilities.
4. No fill or backfill operations shall be performed when weather conditions are too wet or too cold to permit satisfactory results.

3.3.2 Trench Backfill - Trenches shall be backfilled after conduit has been installed on bedding. Conduit shall be placed on a 4-inch bedding of natural sand or earth containing no materials that would be maintained on a ¼-inch sieve. The next 8 inches of backfill shall consist of materials that would be maintained on a 1-inch sieve. The remaining backfill shall consist of excavated materials that contain no aggregates larger than 4-inches diameter. Fill materials in this layer shall be thoroughly compacted to firmly bed the cables and/or conduits. Backfill around existing utility lines exposed during trenching operations shall conform to this paragraph. All subsequent layers shall be 6 inches deep, loose measurement with care taken to assure that the bare copper guard wire and the red plastic warning tape are integrated at the appropriate depth. Backfill shall be spread in layers and be compacted by mechanical tampers. In such cases, the backfill material shall be placed in successive layers not exceeding 6 inches in loose thickness, and each layer shall be compacted with mechanical tampers to the density specified herein. Mechanical tampers shall be of the impact type as approved by the RE. Trenches shall be completely backfilled, leaving a 2-inch mound above the level of the surrounding grade to allow for future settlement. The finished surface materials shall match existing.

3.3.3 Foundation Backfill - Foundation backfill shall be placed and compacted in 6-inch lifts. The use of an imported pit run shall be used to backfill excavated holes. All material placed within structural areas shall be compacted while at a moisture content near optimum and to a dry density that is not less than 98% of the maximum dry density per ASTM D698 or 80% relative density per ASTM D4253/D4254. No backfill materials against concrete shall be placed until the concrete has set for 48 hours and no mechanical means of compaction shall be used against concrete within 72 hours of placement.

3.3.4 Compaction - Excavated subgrade must be inspected by the RE and Geotechnical Engineer upon completion of excavation and before proceeding with next phase.

Compaction tests are to be performed on each lift. Compaction shall be performed using the method and equipment suitable for the areas specified.

Mechanical hand tampers shall be used in areas adjacent to footings or slabs, in trenches, or other areas where use of rollers is not practical.

3.3.5 Geotextile Fabric – Geotextile Fabric shall be applied under all crushed rock as specified in Section 02373.

3.3.6 Foundations – Foundation subgrade shall be compacted to minimum of 98 % of maximum density as determined by ASTM D 698.

3.3.7 Trenches - Trench backfill shall be compacted to at least 95% of maximum density as determined by ASTM D-698.

3.3.8 Adjacent Area - Subgrade adjacent to but not supporting any structural elements or areas within 5 feet of structures shall be compacted by a minimum of two (2) passes of a vibratory compactor with necessary moisture added to material to provide in place density equal to surrounding soil.

3.3.9 Final Grading - Place backfill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of all structures.

3.3.10 Restoration - Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.4 Finish Operations

3.4.1 Disposition of Surplus Material - Surplus or other soil material not required or suitable for filling or backfilling shall be removed from the site and legally disposed of off of Government property

3.4.2 Protection of Surfaces - Protect newly graded areas from traffic, erosion, and settlement. Repair or re-establish damaged grades, elevations, or slopes.

3.4.3 Restoration - All disturbed areas, including grasses, plantings, etc., shall be restored to meet or exceed the original condition. Restoration shall be as reviewed and approved by the Resident Engineer.

3.5 Conduit Installation – All conduits shall be installed and jointed in accordance with manufacturer's recommendations. All conduits shall be laid so that they maintain a minimum positive slope of 1 ½-inch per 100 feet sloping from midpoint between handholes towards the handholes. All conduits shall be provided with end bells wherever the conduits terminate in handholes or vaults. Conduits shall be kept clean of all dirt or foreign substances during and after installation. Field cuts shall be made with the proper tools and shall match factory tapers. Conduit shall be stored to avoid warping and/or deterioration with the ends sufficiently plugged to prevent entry of water or solid substances. Conduits shall be cleaned prior to installation and shall be stored on a flat surface and protected from sunlight. All PVC conduit joints shall be properly cemented in accordance with ASTM D 2564 and ASTM F 656.

3.6 Crushed Stone Surfacing and Foundation Pit Run Gravel – Excavated subgrade must be inspected by Parsons RE and Geotechnical Engineer upon completion of excavation and before proceeding with next phase. Compaction tests are to be performed on each lift.

The foundation backfill fill shall be placed in lifts and compacted to 98% maximum dry density or 80% relative density.

Other areas of fill and backfill including exterior building backfill shall be placed in lifts and compacted to 95% maximum dry density or 75% relative density.

3.7 Open Areas – Backfill in areas where the existing surface is grass or dirt shall be compacted to 85 percent maximum density.

4.0 **QUALITY ASSURANCE**

4.1 Submittals –

Crushed Rock Surface Material

Foundation Gravel Material

Excavation Work Plan (provide to Resident Engineer upon request)

Concrete Splash Blocks for the shelter downspouts

*** * * END OF SECTION * * ***

SECTION 02373

GEOTEXTILE

PART 1 GENERAL

Scope of Work: Geotextile fabric is required under all crushed stone surfacing throughout the RTR site perimeter and the driveway access road. A woven geotextile fabric as identified in Table 3 is required for the crushed rock in this area. This specification covers requirements for geotextiles.

1.1 References

The publications listed below form a part of the specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. ASTM International (ASTM)

ASTM D 4354 Sampling of Geosynthetics for Testing

ASTM D 4355 Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus

ASTM D 4491 Water Permeability of Geotextiles by Permittivity

ASTM D 4533 Trapezoid Tearing Strength of Geotextiles

ASTM D 4632 Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751 Determining Apparent Opening Size of a Geotextile

ASTM D 4759 Determining the Specification Conformance of Geosynthetics

ASTM D 4833 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D 4873 Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 Submittals

Submit the following:

A. Product data.

B. Proposed thread type for sewn seams along with data sheets showing the physical properties of the thread.

C. Manufacturers certificate of compliance stating that the geotextile meets the requirements of this section.

1.3 Delivery, Storage and Handling

Delivery, storage, and handling of geotextiles shall be in accordance with ASTM D 4873.

1.3.1 Delivery

The Resident Engineer shall be notified a minimum of 24 hours prior to delivery and unloading of geotextile rolls. Rolls shall be packaged in an opaque, weatherproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 71° C 160° F, or any other environmental condition that may damage the physical properties of the geotextile. To protect the geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a forklift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 MATERIALS

2.1 Geotextiles

Geotextile shall be woven pervious sheet of polymeric material for the road base stabilization and for the crushed stone surface geotextiles and non-woven for the drainage geotextile and shall consist of long-chain synthetic polymers composed of at least 95% by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make filaments resistant to deterioration by ultra-violet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

2.1.1 Minimum Requirements for Drainage Geotextile

TABLE 1

MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	LBS	160	ASTM D 4632
BURST STRENGTH	PSI	100	ASTM D 4632
PUNCTURE	LBS	55	ASTM D 4833
TRAPEZOIDAL TEAR STRENGTH	LBS	55	ASTM D 4533
APPARENT OPENING SIZE	U.S. SIEVE	30	ASTM D 4751
PERMITTIVITY	SEC -1	.15	ASTM D 4491
ULTRAVIOLET DEGRADATION	PERCENT	50 AT 500 HRS	ASTM D 4355

2.1.2 Minimum Requirements for Road Stabilization Geotextile

TABLE 2

MINIMUM PHYSICAL REQUIREMENTS FOR ROAD STABILIZATION GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB TENSILE STRENGTH	LBS	315	ASTM D 4632
BURST	PSI	600	ASTM D 3786

STRENGTH			
TRAPEZOIDAL TEAR STRENGTH	LBS	120	ASTM D 4533
PUNCTURE STRENGTH	LBS	120	ASTM D 4833
ULTRAVIOLET DEGRADATION	%	70 AT 500 HOURS	ASTM D 4751

2.1.3 Minimum Requirements for Crush Stone Surface Geotextile

TABLE 3

MINIMUM REQUIREMENTS FOR CRUSH STONE SURFACE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB TENSILE STRENGTH	LBS	220	ASTM D 4632
BURST STRENGTH	PSI	500	ASTM D 4632
TRAPEZOIDAL TEAR STRENGTH	LBS	135	ASTM D 4533
PUNCTURE STRENGTH	LBS	115	ASTM D 4833
ULTRAVIOLET DEGRADATION	%	70 at 500 hours	ASTM D 4355

2.2 Thread

Sewn seams shall be constructed with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

PART 3 EXECUTION

3.1 Installation

3.1.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions that could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 02300.

3.1.2 Placement

The subcontractor shall notify the Resident Engineer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls that are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth as that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds and wrinkles. On slopes steeper than 10 horizontal on 1 vertical the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

3.2 Seams

3.2.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, the upper panel shall be lapped over the lower panel of overlapped seams.

3.3 Protection

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextiles shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

3.4 Repairs

Torn or damaged geotextile shall be repaired. Clogged areas of geotextile shall be removed. Repairs shall be performed by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 12 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile rolls that cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to the Government.

3.5 Penetrations

Engineered penetrations of the geotextile shall be constructed by methods recommended by the geotextile manufacturer.

3.6 Covering

Geotextile shall not be covered prior to inspection and approval by the Resident Engineer. Cover soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. On side slopes, soil backfill shall be placed from the bottom of the slope upward. Cover soil shall not be dropped onto the geotextile from a height greater than 1 m 3 feet. No equipment shall be operated directly on top of the geotextile without approval of the Resident Engineer. Equipment with ground pressure less than 7 psi shall be used to place the first lift over the geotextile. Cover soil material type, compaction, and testing requirements are described in Section 02200. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

***** END OF SECTION *****

SECTION 02684

DUCTBANK CONSTRUCTION

PART 1 GENERAL

1.0 General: The Contractor shall provide all labor, equipment, and material to install ductbanks including conduits, fittings, concrete, backfill, warning tape, and appurtenances as specified herein and in the drawings. Locations shall be as shown on the plot plan. Ductbanks and handholes shall comply with referenced drawings. Ductbanks required are as follows:

- 5 x 4" concrete-encased PVC ductbank from shelter to each tower. 3 total ductbanks, approximate length 100 ft. each. These ductbanks will also include a conduit for AC power to each tower, as well as EES grounding wire.
- 1 x 4" concrete-encased PVC ductbank from existing fiber optic MH R1 to the shelter. Approximate length 50 ft.
- Underground conduit for AC power feed from existing Black Hills transformer to the shelter. Approximate length 150 ft.

1.1 Applicable Publications: - Latest edition of the following form a part of this specification:

1.1.1 American Society for Testing and Materials (ASTM).

ASTM A 615-94	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A780	Repair of Damaged and uncoated Areas of Hot–Dipped Galvanized coatings
ASTM C33	Standard specification for concrete aggregates.
ASTM C 94	Standard specification for ready mixed concrete.
ASTM C 150-94	Portland Cement.
ASTM C 618-94a	Coal Fly Ash and Raw of Calcined Natural Pozzolan for users as a Mineral Admixture in Portland Cement Concrete.
ASTM D 1785-93	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
ASTM D 2466-94a	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
ASTM D 2564-93	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

1.1.2 Federal Specifications.

W-C-1094	Conduit and Conduit Fittings: Plastic, Rigid
WW-C-581	Conduit, Metal, Rigid; and Coupling, Elbow and Nipple.

1.1.3 Underwriters' Laboratories, Inc.

UL 651	Schedule 40 and 80 Rigid PVC Conduit
UL 6	Rigid Metal Conduit

1.2 Submittals: The following shall be submitted for review and approval prior to installation.

1.2.1 Precast/Concrete manholes/handholes and covers: product data sheet.

1.2.2 Schedule 40 PVC conduit & fittings: product data sheets.

1.2.3 GRS Conduit & Fittings: product data sheets, (including malleable iron grounding bushings).

1.2.4 Concrete mix design and supplier.

1.2.5 Solvent cement certification.

1.3 Quality Assurance:

1.3.1 Delivery and Storage: Deliver and store materials in a manner that will prevent contamination and damage. Conduits shall be stored to avoid warping and/or deterioration with ends sufficiently plugged to prevent entry of any water and solid substances.

1.3.2 Inspection of Conduits: Prior to placing concrete and prior to any backfilling the conduits shall be inspected and approved by the Contracting Officer's Representative.

PART 2 MATERIALS

2.1 4'x4'x4' Handholes and 6'x6'x4' Handholes: Shall be precast concrete and of the type, configuration and size shown on the plans. Top, walls, and bottom slab shall be reinforced concrete and the walls and bottom shall be monolithic construction with the entire structure designed to withstand an AASHTO classification H-20 loading. Covers shall be as shown on the plans, be designed for an H-20 loading and have a locking, spring-assist door. Concrete exterior shall be precoated with an asphalt damproofing and touched up after installation.

2.1.1 Cable Racks: Heavy duty, non-metallic stanchions made of UL listed glass reinforced

polymer. Saddles to have minimum load rating of 450 pounds and sized to support 16 each 7/8" Heliax cables. Secured to vault interior walls with stainless steel hardware.

2.2 Polyvinyl Chloride (PVC) Plastic Pipe: Shall be 4 inch inside diameter, schedule 40, heavy wall rigid plastic with PVC fittings and accessories designed for direct earth burial; shall be in 20 sections; and shall conform to Federal specification W-C-1094, and ASTM D 1785 and be listed in UL 651. Fittings shall be in accordance with ASTM D 2564.

2.2.1 Duct Spacers: PVC conduits to be encased in concrete shall be supported and separated with non-metallic duct spacers that interlock and provide the required ground and conduit clearances.

2.3 Galvanized Rigid Steel Conduit (GRS): Shall be 4 inch inside diameter, hot dipped galvanized steel conforming to Federal Specification WW-C-581 and UL6. All fittings shall be threaded type and of the same material as the conduit.

2.4 Cable Pulling Irons: Shall be of galvanized steel located opposite of each duct entry.

2.5 Duct Encasing Concrete: Shall be minimum compressive strength of 4000 psi at 28 days with "P" gravel. Concrete shall have a 0.50 maximum water/cement ratio, 4 ½% to 6 ½% air entrainment, and a maximum 3-inch slump. Concrete shall be proportioned in accordance with ASTM C94 for ready mixed concrete. Maximum aggregate size shall be ¾" per ASTM C33.

2.6 Bituminous Dampproofing: Cold applied asphalt Type 1 meeting ASTM D 449.

2.7 Solvent-Cemented Joints: Shall be in accordance with ASTM D 2564.

2.8 Pull Cords: Shall be ¼" diameter, polypropylene tested at 720 pounds minimum.

2.9 Warning Tape: Shall be orange plastic, 6" wide, 6 mil minimum thickness, permanently imprinted with an appropriate legend, and located to the dimensions shown on the plans.

2.10 Handhole Covers: Shall be marked "FAA-COMM" on the cover. The markings shall be cast into the steel covers or die stamped into a nominal $^{1}/_{16}$" minimum thickness copper plate brazed or fastened to the cover with a minimum of two 10-32 brass screws.

2.11 End Caps: All conduit terminations shall include end caps of the same material appropriately sized to the duct. End caps shall be dirt and water-resistant and have a pull rope tie off point.

2.12 Reinforcement: ASTM A 615 Grade 60 unless otherwise specified.

2.13 Tracer/ Ground Wire: 1/0 AWG bare copper ground wire.

2.14 Innerduct: Innerduct shall be orange corrugated, polyethylene tubing of 1-1/4" nominal diameter in compliance with ASTM D3350 and with pre-installed, pre-lubricated, woven polyester tape with footage markings. Tape shall be a minimum of 1250 lb. strength.

PART 3 EXECUTION

3.1 Conduit Installation: - All conduits shall be installed and jointed in accordance with these specifications and the manufacturer's recommendations. Conduits shall be as shown on the plans – all sweeps and bends to be fabricated from GRS and all buried straight sections concrete-encased PVC. Conduits shall be installed as shown on drawings. All conduits shall be separated from any existing, crossing utility by a minimum of 12 inches in all directions – both vertically and horizontally. All conduits shall be laid so that they maintain a minimum positive slope of 2" per 100 feet sloping toward the handholes. Conduits shall be kept clean of all water, concrete, dirt, or foreign substances during and after installation. Where conduit has to be cut in the field, it shall be cut square using a proper pipe cutting tool. The cut ends of a field cut shall be reamed to remove burrs and sharp edges and they shall be redone to match factory tapers or threads. Pull cord shall be installed in each conduit.

3.2 PVC Conduit: All PVC conduit joints shall be properly cemented in accordance with the manufacturer's recommendations and these specifications. PVC conduits shall be stored on a flat surface and protected from direct sunlight. All conduits shall be provided with end bells wherever the conduits terminate in a vault.

3.3 GRS Conduit: GRS conduits shall be free of defects upon installation; any marring of the galvanized surfaces during installation shall be repaired with three coats of a zinc-rich paint. Field cut threads shall have the same effective length, thread dimensions and taper as specified for factory cut threads. Conduits with threads not complying with factory specifications shall not be installed. Clean threads of all oil and shavings and apply three coats of a cold zinc rich paint to the damaged galvanized surfaces in accordance with ASTM A780. One coat only on threads. All conduits shall be provided with an insulated, grounding bushing and double locknut wherever the conduits terminate in a vault or junction box. Underground conduits shall be field wrapped with 0.010 inch pipe wrapping plastic tape applied coating with minimum thickness as follows: a) Low or medium density plastic – 0.020 inch; b) Epoxy resin – 0.0008 inch or c) Coal-tar enamel – 0.063 inch.

3.4 Concrete Encasement for PVC Conduits: Concrete encasement shall be by monolithic construction. All spacers and blocking shall be made of steel, concrete, plastic or combination of these materials and shall be placed at a maximum of 4 feet on center along the centerline of the trench. Conduits shall be properly spaced and securely

anchored to prevent displacement during the concrete placement. The contractor is responsible for dewatering and maintaining trenches. No concrete shall be placed in water or on a wet subgrade. The contractor shall provide a marker designating the top elevation of the concrete prior to placement. Vibration and concrete curing techniques (compounds, burlap, etc.) are not required. However, the contractor shall rod the concrete as necessary to assure full placement around conduits, rebar, etc. and provide a somewhat even surface, i.e. no peaks and valleys over 3 inches. The contractor shall provide a solid vertical support at the end of each concrete pour. This shall remain in place for 24 hours. The contractor shall not backfill over concrete within the first 24 hours nor prior to the achievement of 2000 psi concrete compression strength.

3.4 Handholes: Handholes shall be installed plumb and at the locations shown on the plans. Handholes shall be placed on a minimum of 12 inches of compacted, free draining material. Frames and covers shall be as indicated on the drawings and conform to section 2.1 of this section. Cover elevations shall be set flush with finish grade. All conduit and other penetrations shall be grouted from both inside and outside to assure a watertight seal. Exterior walls shall be coated with a damproofing material per the manufacturer's recommendations. Each handhole shall be equipped with cable-pulling irons and hot-dipped galvanized "C" channels (one per side).

3.5 Innerducts: The contractor shall install three, polyethylene 1-1/4" Innerducts, each with a footage-marked pull tape, in the 4-inch conduit between fiber optic MH-R1 and the equipment shelter. The pre-installed tape shall be tied to the end caps in each Innerduct at the terminations, i.e. manhole R1 and the conduit body at shelter exterior wall penetration point.

3.6 Cable Racks and Saddles: Install vertically two 4" wide by 24" long stanchions on each of the four interior walls of the larger 6'x6'x4' handholes located at each of the three towers. Install two saddles in each stanchion.

3.7 Warning Tape: A 6-inch wide orange plastic warning tape, 6 mil minimum thickness, shall be continuously imprinted with the appropriate legend and shall be located as shown on the plans.

3.8 Grounding: A #1/0 AWG tracer/ground for each ductbank shall be installed and connected per the drawings.

*** * * END OF SECTION * * ***

SECTION 03307

CONCRETE FOR FOUNDATIONS

PART 1 GENERAL

1.1 References: The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Recommended for projects based on older specifications.

ACI INTERNATIONAL (ACI) \-ACI308R

ACI 308R	(2001) Guide to Curing. Concrete
ACI 318/318R	(2002) Building Code Requirements for Structural Concrete and Commentary
ACI 347R	(2001) Guide to Formwork for Concrete

ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M	(2004b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2003) Slump of Hydraulic Cement Concrete
ASTM C 150	(2004a) Portland Cement
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 172	(2004) Sampling Freshly Mixed Concrete
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 39/C 39M	(2004) Compressive Strength of Cylindrical Concrete Specimens
ASTM D 75	(2003) Sampling Aggregates
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete
ASTM E 96	(2000el) Water Vapor Transmission of Materials

US ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

1.2 Submittals: The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Product Data:

Curing Materials

Reinforcing Steel

Manufacturer's literature is available from suppliers which demonstrate compliance with applicable specifications for the above materials.

Batching and Mixing Equipment

Batching and mixing equipment will be accepted on the basis of manufacturer's data which demonstrates compliance with the applicable specifications.

Conveying and Placing Concrete

The methods and equipment for transporting, handling, depositing, and consolidating the concrete shall be submitted prior to the first concrete placement.

1.2.2 Test Reports:

Aggregates

Aggregates will be accepted on the basis of certificates of compliance and test reports that show the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Concrete Mixture Proportions

Ten days prior to placement of concrete, the contractor shall submit the mixture proportions that will produce concrete of the quality required. Applicable test reports shall be submitted to verify that the concrete mixture proportions selected will produce concrete of the quality specified.

1.2.3 Certificates:

Cementitious Materials

Certificates of compliance attesting that the concrete materials meet the requirements of the specifications shall be submitted in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Cementitious material will be accepted on the basis of a manufacturer's

certificate of compliance, accompanied by mill test reports that the material(s) meet the requirements of the specification under which it is furnished.

Aggregates

Aggregates will be accepted on the basis of certificates of compliance and test reports that show the materials shall meet the quality and grading requirements of the specifications under which it is furnished.

1.3 Unit Prices: N/A

1.4 Design and Performance Requirements:

The FAA RE will maintain the option to sample and test aggregates and concrete to determine compliance with the specifications. The Contractor shall provide facilities and labor as may be necessary to assist the FAA RE in procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Concrete will be sampled in accordance with ASTM C 172. Slump will be determined in accordance with ASTM C 143/C 143M, when cylinders are molded. Compression test specimens will be made, cured, and transported in accordance with ASTM C 31/C 31M. Compression test specimens will be tested in accordance with ASTM C 39/C 39M.

Samples for strength tests will be taken not less than once each shift in which concrete is produced. A minimum of three specimens will be made from each sample; two will be tested at 28 days for acceptance, and one will be tested at 7 days for information.

1.4.1 Strength

Acceptance test results will be the average strengths of two specimens tested at 28 days. The strength of the concrete will be considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f’c, and no individual acceptance test result falls below f'c by more than 500 psi.

1.4.2 Construction Tolerances

A Class "C" finish shall apply to all surfaces of the concrete foundation finish. The surface requirements for the class of finish required shall be as specified in ACI347R.

1.4.3 Concrete Mixture Proportions

Concrete mixture proportions shall be the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine

and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project specified compressive strength f'c shall be 4000 psi at 28 days, nominal size coarse aggregate shall be 3/4 inch in accordance with ACI 318/318R.

Air content shall be between 4.5 and 7.5 percent.
The slump shall be 3 inches.
The maximum water cement ratio shall be 0.50

PART 2 PRODUCTS

2.1 Materials:

2.1.1 Cementitious Materials listed below shall conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C 150, Type II.

2.1.2 Aggregates

Aggregates shall meet the quality and grading requirements of ASTM C 33 Class Designations 4M or better.

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed. Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the contractor at the request of the Contracting Officer and shall be rejected if test results are not satisfactory.

2.1.4 Water

Water for mixing and curing shall be fresh, clean, potable, and free from injurious amounts of oil, acid, salt, or alkali, except that un potable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Reinforcing steel bar shall conform to the requirements of ASTM A 615/A 615M, Grade 60. Details of reinforcement not shown shall be in accordance with ACI 318/318R, Chapters 7 and 12.

2.1.6 Formwork

The design and engineering of the formwork as well as its construction shall be the responsibility of the Contractor.

2.1.7 Form Coatings

Forms for exposed surfaces shall be coated with non-staining form oil which shall be applied shortly before concrete is placed.

2.1.8 Curing Materials

Curing materials shall conform to the following requirements.

2.1.8.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C 171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.8.2 Membrane-Forming Curing Compound

ASTM C 309, Type I-D or 2, Class A.

PART 3 EXECUTION

3.1. Preparation:

3.1.1 General

Construction joints shall be prepared to expose coarse aggregate, and the surface shall be clean, damp, and free of laitance. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris, and foreign matter shall have been removed. Earth foundations shall be satisfactorily compacted. Spare vibrators shall be available. The entire preparation shall be accepted by the FAA RE prior to placing.

3.1.2 Embedded Items:

Reinforcement shall be secured in place; joints, anchors, and other embedded items shall have

been positioned. Internal ties shall be arranged so that when the forms are removed the metal part of the tie will be not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.3 Formwork Installation:

Forms shall be properly aligned, adequately supported, and mortar-tight. The form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

3.1.4 Production of Concrete:

3.1.4.1 Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C 94/C 94M except as otherwise specified.

3.2 Conveying and Placing Concrete:

Conveying and placing concrete shall conform to the following requirements:

3.2.1 General

Concrete placement shall not be permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours or 45 minutes when the placing temperature is 85 degrees F or greater unless a retarding admixture is used. Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Concrete shall be deposited as close as possible to its final position in the forms and be so regulated that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. The placement shall be carried on at such a rate that the formation of cold joints will be prevented.

3.2.2 Consolidation

Each layer of concrete shall be consolidated by ridding, spading, or internal vibrating equipment. External vibrating equipment may be used when authorized. Internal vibration shall be systematically accomplished by inserting the vibrator through the fresh concrete in the

layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly at the rate of about 3 inches per second.

3.2.3 Cold-Weather Requirements

No concrete placement shall be made when the ambient temperature is below 35 degrees F or if the ambient temperature is below 40 degrees F and falling. Suitable covering and other means as approved shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. Any concrete damaged by freezing shall be removed and replaced at the expense of the contractor.

3.2.4 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI 308R, is expected to exceed 0.2 pound per square foot per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

3.3 Form Removal:

Forms shall not be removed before the expiration of 24 hours after concrete placement except where otherwise specifically authorized. Supporting forms and shoring shall not be removed until the concrete has cured for at least 5 days. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.4 Finishing:

3.4.1 General

No finishing or repair will be done when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

All fins and loose materials shall be removed, and surface defects including tie holes shall be filled. All honeycomb areas and other defects shall be repaired. All unsound concrete shall be removed from areas to be repaired. Surface defects greater than 1/2 inch in diameter and

holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. The prepared area shall be brush-coated with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filled with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of Portland cement and white cement so that the final color when cured will be the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be trowel finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish 5/16 inch for the trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.4.3.1 Trowel Finish

A trowel finish shall be applied to footing top surfaces. Toweling shall be done immediately following floating to provide a smooth, even, dense finish free from blemishes.

3.5 Curing and Protection:

Beginning immediately after placement and continuing for at least 7 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to the start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

a. Continuous sprinkling or pending

b. Application of absorptive mats or fabrics kept continuously wet

c. Application of sand kept continuously wet

d. Application of impervious sheet material conforming to ASTM C 171**.**

e. Application of membrane-forming curing compound conforming to ASTM C 309, Type I-D, on surfaces permanently exposed to view and Type 2 on other surfaces shall be accomplished in accordance with manufacturer's instructions.

The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for 7 days. If forms are removed prior to the end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in contact with the concrete shall not be allowed to drop more than 15 degrees C (25 degrees F) within a 24 hour period.

3.6 Tests and Inspections:

3.6.1 General

The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Foundation forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Slump

Slump shall be checked twice during each shift that concrete is produced for each class of concrete required. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143/C 143M.

3.6.2.3 Consolidation and Protection

The Contractor shall ensure that the concrete is properly consolidated, finished, protected and cured.

3.6.3 Action Required

3.6.3.1 Placing

The placing of concrete shall not begin until the contractor has verified and notified the FAA RE that an adequate number of acceptable vibrators, which are in working order and have competent operators, are available. Placing shall not be continued if any poured concrete pile is inadequately consolidated.

3.6.3.2 Slump

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment should be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

****END OF SECTION****

SECTION 05500

METAL FABRICATIONS

1. SCOPE

1.1 Scope - This specification sets forth requirements for the following:

- Assembly and Erection of three (3) 25-foot self-supporting eight-arm RTR communication antenna towers. Government-furnished (GFM).

- Installation of Radian Ram rail ladder safety kit (GFM) for each of the towers.

Note: Antenna towers will be fabricated by the Government's fabrication contractor. Anchor bolts, templates, fabrication drawings, and erection documentation will be furnished to the Plants Contractor prior to delivery of the tower assemblies. Information in this specification relating to tower fabrication is provided for informational purposes only.

2. APPLICABLE DOCUMENTS

2.1 FAA Documents - The attached FAA Reference Drawings form a part of this specification and are applicable to the extent specified herein.

2.2 Military and Federal Publications - Tile following Military and Federal publications of the issues in effect on the dale of the request for proposal, form a part of these specifications.

2.2.1 Military Specifications (Mil. Specs.):

- MIL-M-17l94 Metal, Expanded. Steel

2.2.2 Federal Specifications (Fed. Specs.):

- RR-G-661 Grating-Bar Type
- RR-S-00I301 Safety Equipment, Climbing

2.2.3 Occupational Safety and Health Administration (OSHA) Standards:

- Occupational Safety and Health Standards, Title 29, Part 1910

2.3 Other Publications - The following publications of the issues in effect on the date of tile request for proposal form a part of this specification.

2.3.1 American Society for Testing and Materials (ASTM) Specifications:

- A·36 Structural Steel
- A-53 Pipe, Steel Black and Hot Dipped Zinc-Coaled Welded and Seamless Steel Pipe
- A-123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Stripes
- A-153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A-307 Low-Carbon Steel Externally and Internally Threaded Standard Fasteners
- A-325 High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plain Hardened Washers
- A-385 Providing High Quality Zinc Coating (Hot~Dip) on Assembled Products
- A-441 High Strength Low Alloy Structural Steel
- A-501 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A-570 Hot Rolled Carbon Steel Sheet and Strip, Structural Quality
- A-615 Deformed, and Plan Billet Steel Bars for Concrete Reinforcement
- A-618 Hot Formed, Welded and Seamless H.S., Low Alloy Structural Tubing

2.3.2 American Institute of Steel Construction (AISC) Specifications: Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, with Commentary. Specification for Structural Joints Using ASTM Specification A-325.

2.3.3 American Iron and Steel Institute (AISI) Specifications: Specifications for the Design of light gage cold-formed steel structural members.

2.3.4 American National Standards Institute (ANSI) Standards: B 8.22.1 Plain Washers

2.3.5 Electronic Industries Association (EIA): EIA-222-G Structural Standards for Steel Antenna tower and Antenna Supporting Structures

2.3.6 American Concrete Institute (ACI) Building Code:

2.3.7 American Welding Society (AWS): Welding Handbook: D 1.1

3. REQUIREMENTS

3.1 General Requirements – The tower furnished by the tower manufacturer shall be complete in accordance with all specification requirements including anchor bolts and all other hardware essential for erecting the tower. The manufacturer shall provide all materials, supplies, equipment, and services necessary to design, fabricate and prepare for delivery of tower for erection at the Pueblo, Colorado Memorial Airport.

3.2 Description - The towers will be self-supporting type (25 ft.) galvanized steel structures with a platform at the top for mounting an eight-mount arm assembly, and servicing antennas. The tower height shall be measured from the top of the foundation to the top of the hand rail on the platform (plus or minus 12"). The tower will be shipped in a knocked down form, pre-assembled, and ready to be erected in the field using structural bolts only. The tower will be fabricated in no more than four sections to make up the total tower height. The members will be fabricated from angular, tubular, or solid stock. The tower platform will be large enough to permit installation of 8 antennas with 8 ft. minimum separation. This will be accomplished by providing a square or rectangular platform with retractable support arms similar to those shown in appropriate lengths and locations to provide 8 ft. antenna separation. The minimum area for the tower platform will be 42 square feet (sq. ft.). Access to the platform will be gained through a suitable hinged trap door with provision for being padlocked from the bottom. The weight of the trap door will be 30 pounds (lbs.) or less. The trap door system may also be designed to have 2 doors (15 lbs. maximum each). It will be possible to fully open and close the trap door when entering or leaving the platform without disengaging from the safety climbing device. The door will not be able to blow shut by high winds in the fully open position. The minimum clear climbing side opening in the platform will be 1 foot (ft) - 3 inches (in.) each way from the ladder centerline and 2 ft. - 6 in. clear opening from the ladder rung to the back of the opening. The platform will be fabricated from the angle framing members and the floor of the platform will be fabricated from either expanded metal grating or bar type grating. The floor will be secured to the framing. The platform will be provided with guardrail, composed of vertical posts with top and intermediate rail components located 45 in. and 23 in. respectively above the platform floor. The perimeter framing members will support the rail as well as the required antenna mounting brackets as well as provide a 4 in. high toe plate surrounding the platform walk area.

3.3 Design Requirements –

3.3 General: Engineering Standard to be utilized for design is TIA-222-G, with Structure Class II, Exposure C, and Topo Category 1.

3.3.1 Live Load: The floor of the platform shall support a 300 lb. concentrated load over 2.0 sq. ft. area in addition to a live load of 20 lbs. per sq. ft. over the entire platform. In addition to the live load on the platform, the tower and ladder shall be designed to support a minimum 500 lb. concentrated load at any point on the ladder and its attachment to the tower in a free fall of 18 inches. Each individual ladder rung shall be capable of supporting a vertical load of 250 lb.

3.3.2 Wind Load: The tower shall be designed for a Zone C wind load per EIA/TIA Standard 222-G (110 miles per hour (MPH)) to support the platform with 45 in. high handrail plus the following:

(a) A 2-1/2 in. diameter antenna 48-in. long mounted vertically on each of the 8 antenna mounts.
(b) Two junction boxes each having a projected area of 6 sq. ft., mounted on platform railing.
(c) 16 antenna cables, each approximately 1-1/4" diameter routed vertically along the exterior face of the tower from the foundation up to the platform level.
(d) Climbing ladder, face mounted (or interior if there is adequate space) for the full height of the tower, with safety climbing device that is furnished by others.
(e) A single 3-in. diameter 20-foot high air terminal mast that extends vertically from the tower platform.

3.3.3 Tower Legs: The four tower legs shall be fabricated of structural steel, structural angles, or plates having minimum yield strength of 36,000 lbs. per square inch (sq. in.), per ASTM Specification A-36 for angles and plates; or 33,000 lbs. per sq. in., per A-53 or A-501 for pipe. Legs fabricated from steel having minimum yield strength of 50,000 lbs. per sq. in. shall conform to ASTM Specification A~618, Grade 3, for pipe or ASTM Specification A-44l for angles or plates.

3.3.4 Tower Braces: Tower angle braces shall have minimum yield strength of 36,000 lbs. per sq. in., per ASTM Specification A-36.

3.3.5 Base Section: The base section of all self-supporting tower shall be fixed base utilizing load bearing plates drilled to receive anchor bolts cast in reinforced concrete foundations or it may be a short section or integral part of the first tower increment. If a separate short section is used it shall be cast in the concrete foundation and similar in construction to the other tower increments.

3.3.6 Bolted Connections: All bolts for structural joints shall be high strength per ASTM SPECIFICATION A-325 fasteners. Secondary connections where bolts are less than 1/2 in. diameter shall be of Grade 5 (SAE J 429) specification, if conditions permit. All nuts shall have locknuts. All fasteners shall be galvanized

3.3.7 Ladder and Safety Climbing Devices: The ladder shall be face-mounted (interior) for the full height of the tower and extend a minimum of 3 ft. - 6 in. above-the platform. The ladder design shall conform to OSHA standards including clearances and the distance between ladder rungs and ladder rails. The mounting devices that attach the ladder to the tower shall not extend beyond the rail edges on the climbing side of the ladder.

3.3.8 Tower Foundation Design: A foundation design will be provided for the towers and the base of the pad placed at minimum depth of 36 in. below the ground surface. Design will be based on the Geotechnical Analysis provided by FAA (reference Appendix; Kleinfelder Geotechnical Analysis, to be available by March 15, 2012). Maximum allowable soil pressure of 2,500 PSF; Concrete strength shall be based on a 28-day

compressive strength of 4000 pounds per square inch (PSI) and maximum slump of 4 in. Reinforcing steel shall be intermediate grade billet ASTM Specification A-615, Grade 60, deformed bars. The anchor bolts/anchoring system shall be furnished with the tower.

Note: Antenna tower foundation design will be provided by the Government's tower fabrication contractor. Information in this specification relating to tower fabrication is provided for informational purposes only.

3.3.9 Tower Platform Handrails: The top hand rail shall be capable of taking a point load of 200 lbs. in any direction.

3.3.12 Design and Drawings:

3.3.12.1 Work Required - Provide field erection drawings and plans list.

3.3.12.2 Work Preparation - Drawing preparation shall be performed by the contractor to the extent required herein. Design shall be in accordance with established engineering practice and the ACI, AISC, AISI OR EIA specification as applicable. Design drawings shall show control dimensions, member sizes and other details as necessary for the development of shop and erection drawings. Erection drawings shall indicate anchor system, member location, bolt sizes and number and all other information to clearly depict requirements for field erection. A parts list showing the member number, size, and length shall be provided in the erection drawings.

- A copy of the ERECTION DRAWINGS AND PARTS LIST WILL BE SHIPPED WITH THE TOWER.

3.4 Materials - Unless otherwise indicated, materials shall conform to the specifications and other requirements indicated below. Where no specification is indicated, the materials shall be good commercial quality suitable for the Government's intended use and shall be subject to the approval of the Contracting Officer. Unless otherwise provided by the Request for Proposal, the contractor shall furnish all materials and items required for the complete structure, and in addition shall furnish nuts, bolts, washers, and other hardware in an amount 10% in excess of the quantity required for erection.

3.4.1 Structural Steel Plate, Shapes, and Bars: Structural steel plates, shapes, and bars shall conform to ASTM Specification A-36.

3.4.2 Strip Steel: Strip steel shall conform to ASTM Specification A-570 of the appropriate grade.

3.4.3 High-Strength Bolts, Including Nuts and Washers: High strength bolts, nuts, and washers shall conform to ASTM Specification A-325.

3.4.4 Bolts and Nuts, Other Than High Strength: Bolts and nuts other than high strength shall conform to ASTM Specification A-307, Grade A.

3.4.5 Plain Washers, Other Than Those in Contact with High-Strength Bolts, Heads, and Nuts: Plain washers shall conform to ANSI Standard B 18.22.1, Type B.

3.4.6 Locknuts: A jam nut shall be used on each bolt beneath the full nut. Self-locking nuts intended for use on exterior bolted connections with any associated lock washers may be submitted for approval as a substitute for the regular nut and jam nut.

(a) Bar type. Federal Specification RR-G-661.

(b) Expanded Metal Type. Military Specifications MIL-M-17194.

3.5 Fabrication - Fabrication shall be in accordance with the A1SC Specification. Members shall have no sharp edges which will be hazardous during handling or other irregularities which will interfere with erection. The manufacturer shall be responsible for corrections of all fabrication errors and for correct fitting of the fabricated members.

3.5.1 Marking: Each Separate member, except bolts, washer and similar items shall be clearly marked by stamping into the steel in the mark shown in the erection drawings. Marks shall be a minimum of 1/2 in. high. All like parts shall be marked in the same relative position. Marks shall be stamped into the steel before galvanizing and shall be clearly visible in the erected structure.

3.5.2 Galvanizing: All ferrous parts shall be hot dip galvanized after fabrication in conformance with ASTM Specification A-123 and A-385. Hardware (nuts, bolts, washers and other minor items) shall be galvanized by the hot dip method in conformance with A-153. The interior of any pipe used shall be galvanized. Anchor bolts shall be galvanized only in the area which will extend above the concrete foundation.

3.5.3 Antenna Mounting Brackets: Eight antenna pipe mounts shall be furnished with each tower. Bracket details shall be as shown on the attached drawing, Enclosure (1) PUB-D-RTR-S004, RTR Antenna Towers. Alternate support arm designs must be approved in writing by the contracting officer. Retractable support arms or fixed supports adequate for mounting eight antennas with a minimum 8 ft. separation and accessible from the platform shall be furnished with each tower.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality Control - Quality Control shall be in accordance with the American Institute of Steel Construction Specifications. Unless otherwise specified in the specification or in the contract, all tests and inspections to determine compliance with the requirements of the contract

specifications shall be made by the contractor and shall be subject to Government inspection. The Project Engineer and Contracting Officer shall be notified by the Contractor 10 days prior to shipment of required tower to allow the Government representative to inspect tower to be shipped.

5.0 PREPARATION FOR DELIVERY

5.1 Preparation for Delivery – The fabricated tower sections will be delivered to the site in Pueblo, Colorado no later than July 1, 2012. Anchor bolts, templates, and any other materials that will require setting in the concrete foundation will be delivered to the site no later than June 08, 2012. The complete system shall be packed and insured by the carrier and provide safe delivery at destination in containers complying with rules and regulations applicable to the mode of transportation. The packaged system shall be marked with the address to which it is being shipped to and shall include the contract number. Inventory sheet of tower and components shall be included with shipment.

6. OFF-LOADING AT SITE (DESTINATION)

6.1 Offloading at Site (Destination) - The Government does not have loading/unloading capabilities at the Pueblo airport site. Therefore, the tower manufacturer shall arrange for and provide off-loading service at this destination The off-loading equipment shall be provided in the proposal. If off-loading is NOT included, the FAA will reject the proposal.

****** The tower will be offloaded inside an FAA secure area and will require an FAA Escort to the actual location.

7. EXECUTION

7.1 General: The Contractor is responsible for supplying complete structural systems that are ready to be installed on the communication tower foundations. Some field drilling of the existing tower members to support the structures is required:

a) Support structure: vertical alignment within 1 in 250.
b) All other installed fabrications: plus or minus ¼ inch.

7.2 Steel Fabrications: All steel products shall be hot-dipped galvanized after fabrication.

7.3 Markings: Members shall be identified by a painted erection mark. Marking shall not be located in any area to be welded or in any area that would decrease the member strength or cause stress concentrations.

7.4 Storage: Material shall be stored out of contact with the ground in such manner and location as will not cause deterioration or damage.

7.5 Bolted Connections:

a) Punch, subpunch and ream, or drill shop bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust and lubricated immediately prior to installation.

b) Field drilled holes shall not be enlarged more than 1/16 inch larger than specified bolt hole size. No bolt holes may be enlarged or made by burning with a welding torch. Field drilled holes in existing members must be touched up with three coats zinc rich paint.

7.6 Welding: Perform welding, welding inspection, and corrective welding, in accordance with suitable anchoring devices as indicated or as required. Shop welding is to be used for connection in preference to site welding where ever possible. Use continuous welds on all connections. Grind welds smooth prior to galvanizing or applying galvanizing paint in the field.

7.7 Galvanizing Repair: Repair damage to galvanized coatings using three coats of ASTM A780 zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

8. SUBMITTALS

8.1 Plants Contractor:

A. Tower Erection Plan.
B. Radian Ram safety rail installation plan.

END SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

MAJOR ITEMS OF WORK:

1. Installation of LED Obstruction Lights (GFM) on each tower platform.

2. Installation of 115 VAC electrical service outlets on two locations at each tower; one on the platform, and one at the tower base.

3. Installation of wiring conduit, electrical conductor, and related accessories needed to provide power to each antenna tower obstruction light and service outlet.

4. Trenching and installation of 2” rigid underground electrical conduit and 1/0 AWG wire between existing Black Hills transformer and the new shelter meter base. Termination and testing of wire. Approximate distance 150 feet.

5. Provide necessary municipal inspection(s) of the electrical service connections.

MATERIALS:

1. The L-810 LED Obstruction Lights for each of the three antenna towers are government furnished (GFM). All other electrical materials to be provided by the Contractor.

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

1.0 GENERAL REQUIREMENTS

1.1 **Scope** - The work covered under this section consists of furnishing all labor, tools, equipment and material to install the electrical work shown on the drawings and/or described by these specifications. All electrical work shall be in compliance with the current edition of the NFPA 70 National Electric Code (NEC).

1.1.1 **Service Characteristics** - The building is service by Black Hills Energy, it is a single phase 120/240V, 3-wires secondary provided by a 25KVA transformer.

1.1.2 **Utility Service and Interruption of Service** – Contact on site FAA personnel to coordinate outages for power and equipment connections. The FAA Operations at this facility are providing aircraft flight control and assistance information which is required for safety of the aircraft and the public, therefore, any power loss to facility equipment is very serious and must be carefully coordinated with facility personnel. Unscheduled interruptions of electrical service to FAA facilities or equipment may cause aircraft accidents and loss of life. Work requiring a temporary or permanent de-energize of equipment shall be scheduled in writing with the onsite FAA maintenance personnel through the Contracting Officers Representative. Only onsite FAA maintenance personnel are authorized to energize, de-energize equipment or to operate a circuit breaker, switch or fuse in a FAA facility. Determine all interface requirements and provide material and labor needed to complete any connections to be scheduled during an outage. Work procedures shall include lock-out/tag-out procedures in accordance with FAA order 3900.49.

1.1.3 **Interpretation of Contract Drawings** - In general, the drawings utilize accepted diagrammatic symbolism to indicate electrical construction work. The symbols do not have any dimensional significance. The layout of wiring, circuits, outlets, and equipment is developed as an engineering aid and should not be interpreted as a release from responsibility for installing the work without space conflicts; however, all work shall be installed in accordance with the diagrammatic intent of the drawings. The contract drawings indicate the extent and approximate location and arrangement of equipment, conduit, and wiring. The Contractor shall determine exact location from field measurements, so that the outlets and equipment will be properly located and accessible. If any conflicts occur necessitating departures from the contract drawings, details of departures and reason shall be submitted as soon as possible for written approval from the Site Representative. In the event of a discrepancy between the specifications and the drawings, the specifications shall prevail.

1.1.4 **Codes** - The installation shall conform to this specification and to the applicable rules of FAA standards, the National Electrical Code edition or local code, whichever requires the highest quality of material and workmanship. The following specifications and standards of the issues currently in force, form a part of this section, and are applicable to this contract:
NOTE: All electrical work shall be in compliance with the current edition of: NFPA 70 National Electric Code (NEC), FAA C-1217-f, and FAA-STD-019e.

1.1.5 **Workmanship** - All electrical installation work shall be performed by experienced electricians regularly engaged in this type of work and properly licensed when required. All materials and equipment shall be installed in conformance with the contract documents, and in accordance with recommendations of the manufacturer as verified by the Site Representative.

1.1.6 **Minor Departures** - Minor departures from exact dimensions shown in electrical plans may be permitted where required to avoid conflict or unnecessary difficulty in placement of a dimensioned item, provided all contract requirements are met. The Contractor shall promptly obtain approval from the Subcontract Administrator, via the Site Representative prior to undertaking any such proposed departure.

1.2 **Applicable Documents** - The following specifications and standards of the issues currently in force, form a part of this section, and are applicable as specified herein: (Current revisions of the applicable documents and codes shall be utilized for all work completed under this contract.)

1.2.1 **Federal Specifications**

FAA-C-1217f	Electrical Work, Interior
FAA-STD-019e	Lightning Protection, Grounding, Bonding and Shielding for Facilities
FAA-STD-020b	Transient Protection, Grounding, Bonding and Shielding Requirements for Equipment
FAA-C-1391b	Installation and Splicing of Underground Cables.
HH-I-510 B	Insulation Tape, Electrical, Friction
HH-I-553	Insulation Tape, Electrical (Rubber, Natural and Synthetic)
HH-I-595 A	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic, or Low-Temperature Application
J-C-30(2)	Cable and Wire, Electrical (Power, Fixed Installation)
QQ-W-343	Wire, Electrical, (Uninsulated)
W-B-30	Ballast, Fluorescent Lamp
W-B-375	Circuit Breakers, Molded Case; Branch Circuit and Service
W-C-586	Conduit Outlet Boxes, Bodies and Entrance Caps
W-C-1094	Conduit and Conduit Fittings; Plastic, Rigid
W-F-406 B	Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
W-F-408 B	Fittings for Conduit, Metal, Rigid (Thick-Wall and Thin-Wall [EMT] Type)
W-F-414	Fixture, Lighting (Fluorescent, Alternation Current, Recessed and Surface Ceiling)
W-J-800 C(1)	Junction Box; Extension, Junction Box; Cover, Junction Box (Steel, Cadmium, or Zinc-Coated)
W-P-115	Panel, Power Distribution
W-S-610 B(1)	Splice, Conductor
W-S-865	Switch, Box (Enclosed), Surface - Mounted
WW-C-563	Conduit, Metal, Rigid, and Bend and Elbow, Electrical Conduit: Thin wall Type (EMT)
WW-C-566	Conduit, Metal, Flexible

WW-C-581 D(3)	Conduit, Metal Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit, Zinc-Coated
WW-C-582	Surface Metal Raceways

1.2.2 National Fire Protection Association (NFPA) Publications -

No. 70	National Electrical Code - 2002 edition
No. 780	Lightning Protection Code

1.2.3 Insulated Cable Engineers Association (ICEA) Publications

S-19-81	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
S-66-524	Cross-Linked Thermosetting-Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for Transmission and Distribution of Electrical Energy

1.2.4 Underwriter's Laboratories, Inc., UL Standards -

UL 96A	Master Labeled Lightning Protection Systems
UL 651	Schedule 40 and 80 Rigid PVC Conduit
UL 50	Building Materials List Cabinets and Boxes
UL 542	Lamp holders, Starters, and Starter Holders for Fluorescent Lamps
UL 870	Wire ways, Auxiliary Gutters and Associated Fittings.

1.2.5 National Electrical Manufacturers Association (NEMA) -

TC2	Electric Plastic Tubing (EPT), Conduit (EPC-40 and EPC-80) and Fittings
TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
WC 5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
WD1	General Purpose Wiring Devices

1.2.6 Other Documents

1.2.6.1 Local Utility Companies - The rules and regulations of the local utility companies providing service.

1.3 Submittals - See Division 1, Section 01300 of these specifications.

2.0 MATERIALS

2.1 General - All contractor-furnished materials shall be new and the best of its respective kind and, where applicable, materials shall bear the seal of the Underwriter's Laboratories, Inc. Materials and equipment shall conform to respective publications and other requirements specified below. Other materials and equipment shall be as specified elsewhere herein and as shown on the drawings and

shall be the products of manufacturers regularly engaged in the manufacture of such products. All installation materials and practices shall be in strict compliance with FAA-C-1217f.

2.1.1 **Short Circuit Analysis and Protective Device Coordination** – All fuses and circuit breakers included within this electrical power distribution system have been analyzed with the design short circuit and protective device coordination studies. Any changes or other manufacturer components that are different than those specified in these specifications could compromise the design analysis for this modification. All protective devices obtained by the Contractor for installation as per this specification shall be, as specified, or a coordination study must be performed by a Professional Engineer at the Contractor's expense, and is subject to submittal and approval by the Site Representative. Submit time vs. current curves and all manufacturers specifications for these devices for approval. These documents shall be submitted to the Site Representative per section 01300 of these specifications.

2.2 **Conductors -**

2.2.1 **Uninsulated Conductors** shall be copper and shall only be used where specifically identified within the contract drawings. Uninsulated conductors shall comply with Federal Specifications QQ-W-343.

2.2.2 **Insulated Conductors** shall be copper in accordance with Federal Specifications J-C-30.

2.2.3 **Size and Type Conductors** - Unless indicated otherwise on the contract drawings, all conductors shall be soft drawn copper with thermoplastic or thermosetting insulation type THW, THWN, and XHHW for general use, or type THHN for use in dry locations only. Control wire shall be stranded. The minimum size wire, except for control wiring, shall be No. 12 AWG. Control wire shall be no smaller than No. 14 AWG. Power conductors #10 AWG and smaller shall be solid, #8 and larger shall be stranded. All temperature limitations for conductors shall be met per NEC 110-14C and table 310-16.

2.2.4 **Wire Delivery** - Wire and cable shall be delivered to the project site in original boxes and factory reels. Insulation shall have repetitive markings stating the manufacturer, size, type of insulation, etc.

2.3 **Conductor Splices, Terminations, and Connectors** - Federal Specification W-S-610: Splices in stranded wire, and wire No. 8 and larger, shall be made with compression connectors. Splices in Wire No. 10 and smaller (solid) shall be made with wire nuts and taped. In either case, the splice shall be made both mechanically and electrically secure. Comply with paragraph 110-14 (a) of the National Electrical Code. Two or more cables are not allowed to terminate with one single lug designed for only one single termination.

2.4 **Tape** - **Friction Tape** - Federal Specification HH-I-510.
Plastic Tape - Federal Specification HH-I-595.
Rubber Tape - Federal Specification HH-I-553.

2.5 **Fittings, Cable and Conduit** - Federal Specification W-F-406 and W-F-408.

2.6 **Outlet Boxes - Sheet Steel** - Boxes shall be either the cast metal hub type (for receptacles) conforming to Federal Specification W-C-596 or shall be one piece galvanized steel (NEMA-1 and 2 for dry and interior locations and NEMA 3 and 4 for wet and exterior locations) type conforming to Federal Specification W-J-800. Where not sized on the drawings, boxes shall be sized in accordance with the NEC. Boxes shall be provided in the wiring or raceway system for pulling wires, making connections, and mounting devices. Each box shall have the volume required by the National Electrical Code for the number of conductors in the box. Each outlet and switch box shall include a grounding pigtail. Boxes installed for concealed wiring shall be provided with extension rings or plaster covers. Boxes shall not be supported from sheet metal roof decks. Boxes and supports shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units. In open overhead spaces, cast metal boxes threaded to raceways need not be separately supported. All exterior above ground receptacles and junction boxes shall be weatherproof.

2.7 **Raceways** -

2.7.1 **Galvanized Rigid Steel Conduit (GRS)** - Federal Specification WW-C-581, hot-dip galvanized. All fittings shall be threaded. All connectors shall include insulated bushings.

2.7.2 **Tubing, Electrical, Zinc-Coated Metallic Steel (EMT)** - Federal Specification WW-C-563. EMT shall be mild steel, electrically welded, electro-galvanized and labeled with Underwriter Laboratory seal of approval. All EMT fittings shall be compression type. Indentor type, set-screw type fitting will not be accepted. EMT connectors shall include insulated bushings.

2.7.3 **Flexible Metal Conduit** - Federal Specification WW-C-566. Flexible metal conduit shall be galvanized steel conforming in all respects to Underwriter's Laboratories Standards. Flexible metal conduit and fittings shall be UL Listed as grounding type.

2.7.4 **Plastic Conduit** - Polyvinyl Chloride (PVC) conduit shall be schedule 40, heavy wall rigid plastic with fittings and accessories designed for direct earth burial. Exposed PVC conduit shall be sunlight resistant. Manufactured to NEMA TC-2 and Federal Specification W-C-1094; UL listed.

2.7.5 **Flexible Electric Non-Metallic Tubing** - Flexible electric non-metallic tubing shall not be used.

2.8 **Fuses** - A complete set of fuses shall be installed and one set of spares shall be furnished for each fusible device. Fuses shall have a voltage rating not less than the circuit voltage. Fuse types shall be as indicated in the construction drawings.

2.9 **Junction and Pull Box** – Indoor junction and pull boxes for electrical work shall be code gauge sheet steel and provided with a flat screw cover. Exterior junction boxes shall be NEMA 4 type. Power and Control wiring shall not occupy the same junction box.

2.10 **Wireways** - Square duct type wireways shall conform to UL Standard 870. Wireways shall be sized as shown on the construction drawings and shall be hinged cover type. Wiring gutters shall be electrically bonded together.

2.11 **Lighting and Power Panelboards** - Panelboards shall conform to Federal Specification W-P-115, Type I, Class 1, and shall be listed by UL. Panelboards shall have a full-length piano hinged door-in-door cover. Door hinges shall be concealed. Doors over 48 inches high shall have auxiliary fasteners on top and bottom. All panel board doors, which include locks, shall have flush type cylinder locks and catches, keyed alike, with two keys furnished with each lock. Panelboards shall be dead front type, circuit breaker equipped with copper buses. The panel board shall be constructed of code gage galvanized sheet metal and shall be finished with a rust inhibiting prime coat and two coats of light gray enamel.

2.11.1 **Circuit Breakers** - All circuit breakers shall be the quick-made, quick-break, bolt on, thermal magnetic type, shall conform to Federal Specification W-C-375, and shall be U.L. listed. Circuit breakers shall be rated for the voltage of the circuit on which they are used, and shall have a minimum interrupting rating of 10,000 amperes, symmetrical for branch breakers, and 22,000 amperes, symmetrical for main breakers unless indicated otherwise. All circuit breakers shall have a trip indicating feature. Single pole breakers shall be a full size module, and two and three pole breakers shall be sized in even multiples of a single pole breaker. A submittal is required from the Contractor for characteristic curves for main and branch circuit breakers. Breakers shall be sized so that two single pole breakers shall not be capable of fitting in a single housing. Multipole circuit breakers shall have an internal common trip mechanism. All circuit breakers and the panel boards in which the breakers are installed shall be made by the same manufacturer and shall be UL listed for the panel board. Self-enclosed circuit breakers shall be mounted in NEMA OS-1, Type 1 enclosures with trip rating, voltage rating, and number of poles as indicated on drawings.

2.11.2 **Bus Bars** - All buses (phase, neutral, & ground) shall be copper. Bus capacity shall be as indicated on the drawings. Circuit breaker current carrying connections to bus shall be of the bolted type, and factory assembled. Stab in types are not acceptable. Bus bar connections to branch circuit breakers shall be of the sequence phase type. The neutral bus shall be insulated from panel boards. All panel boards shall have an uninsulated ground bus bolted to the cabinet, with provision for individual branch circuit ground conductor connections, adequate in size to accommodate present and future equipment grounding conductors. Isolate ground bus from the neutral bus. The ground bus bar shall be structurally integral to the panel board or attached to the panel board with a bolt, nut and lock washer. If the ground bus bar is mounted to the enclosures with screw threads only, a separate, bolted ground lug shall be installed on the panel board and bonded to the ground bus bar.

2.11.3 **Directories** - Directories shall be typed to indicate the load served by each circuit and shall be mounted in a holder with protective covering. The directory shall be arranged so that the typed entries simulate the circuit breaker positions in the panel board. Circuits shall be connected as indicated on drawing. Any changes shall be “As-Built” on the drawings and a new directory shall be typed to reflect the change.

2.11.4 Existing Breaker Panelboards - When adding circuits to an existing panel board, the new breakers shall be made by the same manufacturer as the panel board.

2.11.5 Fusible Panelboards -

2.11.5.1 General – Fusible Panelboards shall be Square-D, Type QMB unless specified otherwise. No substitutions are allowed without obtaining approval from the Site Representative. Phase Bus Bars shall be copper. Ground and neutral bus bars shall be made of copper. Covers shall be hinged door in door construction. The neutral bus shall be insulated from panel board ground bus and enclosure. Fusible switches shall be included as shown in the construction drawings. Switches rated 30A, 60A, and 100A shall be double density. Switches rated over 100A shall be single density. Provide fuses as indicated in the one-line diagram. Panelboards shall have minimum AIC rating of 100,000A.

2.12 Disconnecting Means - Safety switches shall be heavy-duty types. Disconnecting means installed in exterior locations shall be NEMA-4. Disconnects shall be for the voltage classification indicated on the drawings. All current carrying parts shall be copper. The Contractor shall install disconnects which meet the applicable requirements of the National Electrical Code (NEC) and FAA C-1217f.

2.13 Surge Suppression Equipment – Specifications below taken from FAA-STD-019e. Refer to FAA-STD-019e when purchasing surge suppression equipment.

2.13.1 Service Entrance Surge Arrester - A fused secondary surge arrester provided with disconnect capability shall be installed on the load side of the service disconnect as close as possible to the service terminals. Separate terminating lugs shall be provided within the service disconnect for the surge arrester. The arrester input shall be internally fused for short circuit protection and shall include disconnect capability. The enclosure door shall include indicating lights to demonstrate that each suppression device is functional. Each suppression device within the arrester shall be replaceable as a unit. Outdoor arresters shall come with a NEMA 4 enclosure and enclosure penetrations shall be watertight. Indoor arresters shall come with a NEMA 12 enclosure. Arresters shall be tested in accordance with ANSI/IEEE C62.11. In addition the arrester shall meet the following requirements:

1. Modes of protection: L-N, L-L, L-G
2. Peak Surge Current: 150kA L-N (8x20uSec wave shape)
3. Clamping Voltage: 400V L-N & L-G, 700V L-L (C3 Impulse Wave, 20,000V, 10,000A)
4. TVSS shall be Rayvoss 120-3Y-A1-4-06-A

2.13.2 Branch and Feeder Panel Surge Protective Device – Each individual branch and feeder panel shall have a Surge Protective Device (SPD) installed. The SPD shall be installed on a dedicated circuit. The SPD shall be located as close as possible to the panel board, with the wires being as short and straight as possible. Kinks and sharp bends shall be avoided. The enclosure door shall include indicating lights to demonstrate that each suppression device is functional. Each suppression device within the arrester shall be replaceable as a unit. Outdoor SPDs shall come with a NEMA 4 enclosure and enclosure penetrations shall be watertight. Indoor SPDs shall come

with a NEMA 12 enclosure. Arresters shall be tested in accordance with ANSI/IEEE C62.11. In addition the arrester shall meet the following requirements:

1. Modes of protection: L-N, L-L, L-G
2. Peak Surge Current: 150kA L-N (8x20uSec wave shape)
3. Clamping Voltage: 475V L-N & L-G, 775V L-L (C3 Impulse Wave, 20,000V, 10,000A)
4. Shall be Rayvoss 120-3Y-M3-4-06-A

2.14 **Emergency Lighting Fixtures** - Each fixture shall have twin sealed beam lamp, 25 watt, 6 volt, Nickel-cadmium back-up battery rated for one hour. Emergency lights shall conform to Federal Specification W-L-305, type I, class I, style D, or E, with the number of heads as indicated on the drawings. Emergency light sets shall be connected to the wiring system by a cord no more than 3 feet in length to a single receptacle. Aim lights toward critical pathways. The Site Representative shall approve exact location and aiming.

3.0 EXECUTION

3.1 **General** - The rules, regulations and specifications referenced herein shall be considered as minimum requirements and shall not relieve the Contractor from furnishing and installing higher grades of materials and workmanship than are specified. This specification shall govern when conflicts occur between referenced documents and this specification. All materials and equipment shall be installed in accordance with the contact drawings and the recommendations of the manufacturer as approved by the Site Representative.

3.2 **Working Clearances** - All electrical equipment installed under this project shall be in compliance with NEC Article 110-26. In no case shall the working clearances of existing equipment be infringed upon by new equipment installed under this contract.

3.3 **Raceway Installations** -

3.3.1 **General** - Panelboards, surge arresters, disconnect switches, etc., shall not be used as raceways for conductor routing other than conductors that originate or terminate in these enclosures. Isolated ground conductor will be allowed to traverse these enclosures. Minimum conduit or tubing size shall be ¾-inch, but may be ½-inch for control wiring. Each run shall be complete before conductors are pulled into the conduit and shall be swabbed before conductors are installed. All conduit terminations shall include insulated bushings. Ends of conduit systems not terminated in boxes or cabinets shall be capped. Crushed or deformed raceways shall not be installed. All metallic conduit enclosing AC service lines shall be terminated using conductive fittings to panel board, the power meter, and to the service. All buried metallic conduit enclosing signal, control, status and other power lines shall be terminated using conductive fittings to facility junction boxes, equipment cabinets, enclosures, or other grounded metal structure.

3.3.2 **Conduit Installations** - The wiring method shall consist of insulated copper conductors pulled into rigid metallic conduit, electrical metallic tubing (EMT), or flexible metallic conduit. Conduit system

shall be installed complete before conductors are pulled into the conduit. Each run shall be cleaned and swabbed before conductors are installed. The minimum size conduit shall be ¾", and may be ½" minimum for control wiring. All conduit terminations shall include insulated bushings. Unless otherwise noted on the drawings, conduit installations shall run parallel or perpendicular to the building lines in a neat and workmanlike manner. Location of exposed conduit runs will be subject to approval of the Site Representative. Conduit shall be supported as per NEC requirements. All unused conduits shall have a pull string/wire installed with a minimum tensile strength of 200lbs. Ten inches minimum slack shall be left at each end of the conduit.

3.3.3 **Field Bends** - Field bends shall be avoided where possible and where necessary shall be made with standard, approved hickeys and conduit bending devices.

3.3.4 **Field Cutting and Threading** - All field cut conduits shall be square cut and the ends carefully reamed to remove all burrs. Conduit threads shall be tapered such that they provide continuity and solidly grounded connections. The use of running threads will not be permitted.

3.3.5 **Holes and Sleeves** - The contractor shall provide all holes and sleeves necessary to install conduit and equipment. All required flashing, escutcheon, and sleeves shall be contractor furnished.

3.3.6 **Galvanized Rigid Steel (GRS)** - Rigid steel conduit maybe used in all locations. For installation below slab or underground, the conduit shall be factory coated with either .008 inch of epoxy resin per Spec. MIL-R-21931, .020 inch of polyvinyl chloride, or .063 inch of coal tar enamel per Spec. MIL-P-15147, or shall be field wrapped with .01 inch thick pipe wrapping plastic tape designed for this purpose applied with 50% overlap. Method used requires prior approval by the Site Representative. All fittings for use with rigid steel conduit shall be of threaded type of the same material as the conduit. Where conduits enter NEMA type 1 boxes or cabinets without threaded hubs, grounding type double locknuts plus a phenolic insulated bushing or a metallic grounding bushing shall be used on the open end. For all other types of boxes and cabinets, use grounding hubs.

3.3.7 **Electrical Metallic Tubing (EMT)** - EMT may be used only in dry interior locations, and where not subject to physical damage. Fittings to be used with EMT shall be standard fittings designed for use with this type of conduit. All EMT fittings shall be the compression type. Indenter or set-screw type fittings will not be acceptable. EMT connectors shall include insulated bushings. Where conduits enter enclosures without threaded hubs, an appropriate threaded connector with cast or machined threads (not sheet metal) and locknut shall be used to securely bond the conduit to the enclosure. In addition, connectors shall have an insulated throat, smooth bell shaped end, or a metallic insulated bushing shall be installed on the interior threaded end of the conduit to protect conductor insulation. Insulated bushings shall be provided to bond ground conductor to raceway. EMT shall not be used on circuits above 600 volts, nor in sizes greater than 3 inches in diameter.

3.3.8 **Flexible Steel Conduit, and Liquid tight Flexible Metal Conduit** - Flexible steel conduit shall be in 6-feet or less nominal lengths for terminal connections to motors or motor driven equipment, and may be used in short lengths for other applications as permitted by the NEC. Liquid tight flexible conduit shall be used outdoors or in wet locations. A separate ground conductor shall be provided

across all flexible connections, in addition to the green equipment ground, and terminated to flexible metal conduit connectors designed for this purpose. This separate ground conductor shall be installed on the outside of the flexible connection for inspection purposes and shall be strapped to the conduit between connectors. This conductor shall be 6 AWG. If Liquid tight flexible conduit is required to be longer than six (6) feet in length, the contractor shall obtain approval from the Site Representative.

3.3.9 **Polyvinyl Chloride (PVC or Rigid Nonmetallic) Conduit** – PVC shall be heavy wall conforming to UL 651. PVC may only be used underground, in concrete, or as a 6" maximum vertical riser above grade or floor surface to connect to metal conduit. Make joints in PVC conduit in compliance with manufacturer's instructions. Make all bends by means of an electrical heating unit approved by the conduit manufacturer where standard elbows and fittings cannot be used. Rigid nonmetallic conduit may be used for lightening protection system conductors and indoors to protect signal-grounding conductors.

3.3.10 **Surface Metal Raceways** - Surface metal raceways shall conform to Federal Specification W-C-582. Surface metal raceways shall be installed only in exposed, dry locations where not subject to physical damage.

3.3.11 **Wireways** - Square duct shall only be installed in accessible locations. Covers shall be hinged and shall also have screw fasteners. Wireways installed in wet or damp locations shall be rated for these locations.

3.3.12 **Underground Conduit and Cable Depth Requirements** - Unless otherwise specified, all underground cables, ducts and conduits shall be installed a minimum of 24" deep to top of conduit.

3.4 **Junction, Outlet and Pull Boxes** -

3.4.1 **Special Construction** - Furnish pull boxes as shown on the drawings for cable to be installed by others.

3.4.2 **Junction, Pull and Outlet Boxes** - A junction or outlet box shall be provided at each location indicated in the plans and specification, or where necessary for compliance with the National Electrical Code, or for a neat, workmanlike installation. All boxes shall be of sufficient size and shape to meet code requirements.

3.5 **Supports and Fasteners** - Supporting methods for all electrical equipment and branch circuitry shall conform to the best practice, utilize only approved materials, and satisfy all requirements of the National Electrical Code. Raceways shall be securely supported and fastened in place at intervals of not more than 10 feet with pipe straps, wall brackets, hangers, or ceiling trapeze. Raceways shall also be supported within 3 feet (maximum) of termination. Fastening shall be by toggle bolts on hollow masonry units; by expansion-bolts on concrete or brick; by machine screws, welded threaded studs, or spring tension clamps on steel work. Male type nylon anchors or threaded studs driven in by a power charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel

structures. Raceways shall not be supported from sheet metal roof decks. Do not support conduit or electrical equipment with wire. All metallic electrical support structures shall be electrically continuous and shall be bonded to the multipoint ground system or the Earth Electrode System either directly or indirectly.

3.6 **Cable Installation in Conduit** - The Contractor shall take all necessary precautions to insure against damaging the insulation and conductor during installation in conduit. A non-petroleum based lubricant approved by Underwriters' Laboratories shall be used if necessary to reduce tension during pulling. The cable may be pulled by power winch or by hand. Cable ends shall be sealed with cable end sealing caps or a waterproof tape. Where more than one cable is installed in a conduit, all shall be pulled at the same time. Splices shall not be pulled into a conduit. Control cable shall not be installed in the same conduit as power cable.

3.6.1 **Dedicated Neutral and Grounding Conductor** - Shared/common neutrals shall not be permitted. Neutral conductor sizes shall not be less than the respective feeder or phase conductor. For each circuit installed under this contract, the Contractor shall install a dedicated neutral and equipment grounding conductor throughout the entire circuit. The phase conductor, the neutral and the equipment grounding conductor shall be properly identified as a set at the source panel, in every J-box where a termination takes place and at each electrical device where the circuit terminates. Each utilized single pole over current protective device shall have a dedicated neutral conductor.

3.7 **Cable Termination** - Cable terminations shall conform to NEC Article 110-14. Splices shall be made only at outlets, junction boxes, or in accessible raceways. Terminations of all control, 600V power, and coaxial cables shall be as specified. Care shall be taken not to damage conductors when removing insulation. Compression lugs, properly insulated, should be used whenever possible. Compression splices shall be taped with electrical insulating tape in a manner which makes their insulation equal to the insulation on the conductors. Wire nuts may be used to splice conductors sized #10 AWG and smaller. Wire nuts shall be taped for mechanical security. Compression connectors shall be used to splice conductors #8 AWG and larger. Multiple cables shall not be terminated in lugs listed for only one conductor. Splicing in panel boards is not permitted.

3.8 **Identification** -

3.8.1 **Equipment Identification** - Each of the following types of equipment shall be identified with a nameplate which shows: the functional name of the unit, voltage utilized, single or three phases as applicable, the panel and circuit number powering the equipment, and any other pertinent information. Nameplates shall be non-ferrous metal or rigid plastic, stamped, embossed, or engraved with 3/8-inch minimum height lettering and numerals. The plates shall be secured to the equipment with a minimum of two screws. Switches for local lighting do not need to be identified.

Panelboards
Disconnect Switches
Motor Controllers
E/G Circuit Breaker
Load Bank Circuit Breaker
Load Bank

Load Bank Controller
Battery Charger
Automatic Transfer Switch/Bypass Isolation Switch (ATS/BIS)
Additional equipment shall be identified as required in the construction documents.

3.8.2 **Conductor identification** - In addition to color coding, all feeder, line, phase, branch, and neutral conductors shall be identified by shrink embossed labels, markers, or equivalent means as approved by the Site Representative. Panel and circuit numbers shall be identified. Conductor identification shall be provided at all terminations, and in all junction boxes through which these conductors pass.

3.8.3 **Special Identification** - All panel boards and disconnects which are added or modified in this project shall have the following yellow background type label with black lettering engraved and attached according to section 3.7.1. The first line shall be ½-inch lettering.

CAUTION – SELECTIVELY COORDINATED
THIS EQUIPMENT MUST BE REPLACED WITH
IDENTICAL PROTECTIVE DEVICE TO
MAINTAIN SELECTIVE COORDINATION

3.9 **Color Coding of Power Conductors** - All wiring, including feeders, shall be color coded as specified herein. The color-coding shall be continuous throughout the facility on each phase conductor to its point of utilization so that the conductor phase connection is readily identifiable. All feeder and branch circuits, including neutral conductors, shall be identified at both ends of the conductor with panel and circuit number indicated. Neutral conductors shall be continuous. For conductors No. 4 AWG and larger, where color-coding is not available, color-coded tape, half lapped for a minimum length of 3 inches shall be used. In no case, however, shall green insulated conductors be re-identified for purposes other than grounding, nor shall white or neutral gray conductors be re-identified as other than grounded (neutral) conductors. Where conductors are color coded in this manner, they shall be color coded in all junction boxes and pullboxes, accessible raceways, panel boards, outlets, and switches, as well as at all terminations. Conductors shall be color coded as follows:

Phase Conductors - Phase conductors shall be color coded as follows:

	240/120 V 1-PH 3-W	(240) 208Y/120V 3-PH 3or4-W	480Y/277V 3-PH 4-W
Phase A	Black	Black	Yellow
Phase B	Red	Red	Brown
Phase C		Blue	Orange
Neutral	White	White	Grey/White

Color coding for conductors in control cables shall be in accordance with NEMA Standard WC-5. DC power conductors shall be color coded as follows: Positive conductor, red. Negative conductor, black. The red conductor shall be marked with a positive (+) symbol. The black conductor shall be marked with a negative (-) symbol. Symbols shall be applied using a shrink embossed label.

3.9.1 **Application** - Where color coding is not available, color coded tape, half lapped for a minimum length of 3 inches shall be used. Where conductors are color coded in this manner, they shall be color coded in all junction boxes and pullboxes, accessible raceways, panel boards, outlets, and switches, as well as at all terminations. Conductors in open raceways and junction boxes shall be color coded at a maximum of 3'-0" intervals.

3.10 **Grounding and Bonding** - Grounding shall be in accordance with NFPA 70, FAA-C-1217f (Section 4.4), and FAA-STD-019e. The grounding system for the facility shall be as indicated on the contract drawings and as specified. An equipment grounding system to properly safeguard equipment and personnel shall supplement the grounded neutral of the secondary distribution system. Each over-current device shall have its own equipment-grounding conductor. A green insulated ground wire shall be installed in each conduit used for power conductors to light fixtures, receptacles, and all electrical equipment. All metallic non-current carrying parts of electrical equipment shall be grounded with an equipment grounding conductor whether or not shown on the drawings. When surface metal raceways, wire-ways, or cable rack systems are installed, a separate copper conductor shall be installed on the raceway and shall be properly bonded to each section. The size of this wire shall be #6, unless otherwise indicated.

3.10.1 **Equipment Grounding Conductors** - See Table 250-122 of the National Electrical Code for minimum size of this conductor. Bare conductors shall not be permitted except for exterior use. Where insulation is required it shall be green for equipment grounding conductors number 6 AWG and smaller. Equipment grounding conductors larger than number 6 AWG and equipment grounding conductors in multi-conductor cables (any size) shall be identified by marking all exposed insulation with green tape.

3.11 **The Grounding Electrode Conductor** for the electrical service shall be as sized on the drawings and shall be connected to the earth electrode system with an exothermic weld in an access well. This conductor shall be connected to a neutral bus inside the main service disconnect. This ground bus shall be connected to the neutral bus only at this location.

3.12 **Painting and Finishing** - Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish at the time of final inspection as directed by the Site Representative.

3.13 **Repair of Existing Work** - Electrical work shall be carefully laid out in advance. Where cutting, channeling, chasing, or drilling of floors, wall partitions, ceilings, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, it shall be carefully done. Damage to the building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost.

3.14 **Surge Arrester** - Arrester shall be compatible with the service voltage, and shall be wired to avoid loops, sharp bends and kinks, and to minimize the length of the conductor and number of bends. Arrester enclosure shall be mounted within 4" or less of the service disconnect enclosure and shall be close nipped directly to the service disconnect. Conductor length shall not exceed 12" unless

approved by the Site Representative. There shall be no interconnection between neutral and ground within the arrester.

4.0 QUALITY ASSURANCE

4.1 **General** - The Contractor shall keep records of all tests performed and shall submit, per specification section 01300, a test report to the Site Representative prior to final FAA inspection of the Contractor's work. The report shall list the tests performed and results obtained.

4.1.1 **Tests** - The Contractor shall furnish the instruments, materials and labor necessary to perform the following tests. All tests shall be performed in the presence of the Site Representative or his/her designated representative.

4.1.2 **Continuity Tests** - Before connection of material, the Contractor shall perform continuity testing on all conductors installed under this job. Submit 6 copies of test reports to the Site Representative for approval prior to equipment connections. Test reports shall include circuit number, phase time and date of test, equipment served, test results, and signature of the person conducting the test.

4.1.3 **Insulation Resistance Tests** - Feeders and branch circuits shall have their insulation tested after installation, but before connection to fixtures or appliances. Motors shall be tested for grounds or short circuits after installation but before start-up. All conductors shall test free from short circuits and grounds, and a minimum insulation resistance phase-to-phase and phase-to-ground shall be 30 mega ohms measured with a 500-volt DC insulation resistance tester (As per FAA-C-1217f section 5.3.4.). Apply the test voltage for at least one minute after the meter reading has stabilized. Submit test results to the Site Representative for approval prior to equipment connections. Test reports shall include circuit number, phase, time and date of test, equipment served, test results, and signature of the person conducting the test.

4.1.4 **Earth Resistance Test** - The Contractor shall measure the resistance of the grounding electrode system. A "3-Point Fall of Potential" method shall be employed at the ground well location. Tests shall not be conducted within 48 hours of a rainfall or in frozen soil. The maximum acceptable resistance to ground value shall be 10 ohms or less. The Contractor shall immediately notify the Site Representative if the specified resistance is not obtained. Upon project completion, the Contractor shall also submit a written test report to the Site Representative, defining the test procedure and results obtained.

4.1.5 **Operating Test** - After the interior wiring system installation is completed, and at such time as the Site Representative may direct, the contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of the manufacturer and this specification. The test shall be performed in the presence of the Site Representative or an authorized representative. The contractor shall furnish all instruments and personnel required for the tests. E/G testing shall be performed in accordance with Section 16310.

4.1.6 **Load Balancing** - Before energizing any new electrical 3-phase equipment, which has been installed under this contract, the contractor shall make certain that the phase rotation is positive. Load balancing requires that no single phase load shall exceed a 20% difference between readings in any two phases. The contractor shall take phase angle and load measurements on the service disconnect and each distribution panel and report the results to the Site Representative in writing. These readings shall be taken with all loads energized. The Contractor shall redistribute single-phase loads where there is greater than a 20% difference between readings in any two phases at the approval of the Site Representative and the FAA. The Contractor shall be required to document current readings taken before and after installation, and any phase loaded above 80% of the rating of its over-current protective device.

*** * *End of Section 16050* * ***

SECTION 16136

RACEWAYS, CONDUIT, ENTRIES AND JUNCTION BOXES

PART 1 GENERAL.

1.1 Scope - This specification provides equipment and installation requirements for raceways, conduit, enclosures, and wall entries. It also provides equipment and installation requirements for boxes, including electrical component junction boxes and communication cable junction boxes.

1.2 N/A

1.3 Applicable Publications: The following specifications and standards form a part of this section and are applicable as they apply to this specification. The latest issue of the publications shall be used.

American Society for Testing and Materials (ASTM).

ASTM A780	Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized coatings.

National Fire Protection Association (NFPA) Publication

NFPA 70	National Electric Code

FAA Specifications & Standards

FAA-C-1217f	Electrical work Interior
FAA-STD-019e	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities

Under Writers Laboratories (UL)

UL 50	Enclosures for Electrical Equipment
UL 514A	Metal Outlet Boxes

National Electrical Manufacturers Association (NEMA)

NEMA 250-2003	Enclosures for Electrical Equipment
NEMA OS-1	Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports

PART 2 MATERIALS:

2.1 Government Furnished Materials (GFM): Reference Appendix for complete list.

A. 24”x24”x8” NEMA 4X SS Enclosures with back panels.

B. 48”x36”x12” NEMA 4X SS Enclosures with back panels.

2.2 Contractor Supplied Materials: The Contractor shall supply all the necessary materials and hardware required to install raceways and junction boxes described in this specification. Items not specifically mentioned in this specification, but necessary to complete the installation, shall be furnished without additional fee. These items include, but are not limited to: Conduit, conduit bodies, sealing bushings with ground lugs, wireway, Unistrut, and other related hardware. Unistrut and all hardware used outside the equipment shelter shall be galvanized or stainless steel. Reference Appendix.

2.3 Conduit: Above ground conduit and fittings shall be GRS and be of the types shown on the Project Drawings.

PART 3 EXECUTION:

3.1 General: The rules, regulations and reference specifications enumerated in section shall be considered as minimum requirements. FAA requirements often exceed those of other Standards organizations such as NEC. Adherence to other standards shall not relieve the Contractor from furnishing and installing higher grades of materials and workmanship when so required by this specification.

3.2 Workmanship: All materials and equipment shall be installed in accordance with the contract drawings. Conduit, boxes and raceways shall be installed so that vertical surfaces are plumb and horizontal surfaces are level. The installation shall be accomplished by qualified workers regularly engaged in this type of work. Where required by local regulations, the workers shall be properly licensed.

3.3 Installation of Junction Boxes & Raceway: On towers the enclosures shall be secured to steel safety railing with Unistrut channels and bolts or U-bolts. The following are installation requirements:

A. A minimum of two Unistrut supports attached to at least two rails is required. Bolts which penetrate the box shall be provided with a rubber washer to prevent moisture from entering the box.

B. Unistrut and associated hardware shall be hot-dip galvanized or stainless steel.

3.4 Installation of GRS Conduit: GRS entry into RF enclosures shall be secured with sealing-grounding bushings.

3.5 Raceway and Conduit Grounding: Surface metal raceways, wireways, or cable rack systems shall be installed in a manner that assures electrical continuity. Insulated copper bonding jumpers shall be installed between adjacent raceway sections to assure proper bonding (see section 16670, Grounding and Bonding for details). Also reference FAA-STD-019e.

3.6 Major Items of Work:

A. Install two 24”x24”x8” NEMA 4X enclosures (GFM) on platform handrail of each antenna tower at location shown on drawings, or at specified location as directed by Resident Engineer. Mount to existing handrail with hot-dip galvanized Unistrut and hardware.

B. Install one 48W”x36H”x12” NEMA 4X enclosure (GFM) on exterior wall of equipment shelter at the three locations shown on drawings, or as directed by R.E.

C. Install approximately 100 LF of 12” wide metal wire cable wireway inside the shelter, suspended from ceiling, at locations depicted on drawings. Confirm locations with R.E. prior to installation. Attach 24” lengths of Unistrut to lower surface of wireway, perpendicular to wireway centerline, and approximate spacing every 48 inches along entire wireway to accommodate future conduit.

D. Install 4” GRS riser and LB above building mounted enclosures, with penetration into shelter at location corresponding to position of cable wireways inside the shelter.

E. Install 4” GRS sweep, riser, and LB into shelter from fiber optic ductbank at east side of shelter. Building entry height to correspond with level of cable wireway inside the shelter.

F. Install conduit path to electric meter base from underground electric service to the shelter.

*****END OF SECTION*****

SECTION 16181

CABLE INSTALLATION

PART 1 GENERAL

1.1 Description of the Work:

A. Installation of 7/8" Heliax cables (GFM) between equipment shelter exterior mounted enclosures, and tower platform mounted enclosures.

B. Installation of two 24-strand fiber optic cables (GFM) between the ATCT and the new RTR equipment shelter.

1.2 References:

A. NFPA 70 - National Electrical Code.

PART 2 MATERIALS

2.1 RF Cable – The 7/8" diameter Heliax cable is Government Furnished Material (GFM).

Fiber Optic Cable – the 24-strand Corning cable is government furnished (GFM).

2.2 Strain-relief bushings – Leviton Wire Mesh Safety Grips, or equivalent, to fit the 7/8" Heliax cable as it enters the lower surface of the tower-mounted enclosures.

PART 3 EXECUTION

3.1 Installation:

A. The Contractor shall take all precautions not to damage the (GFM) cable. If the contractor damages or kinks the cable before, during or after installation, he/she shall replace the cable at his/her own expense.

B. No splices shall be permitted in cable runs. They shall be continuous.

C. No bends shall be made during installation of less than 18 inch radius.

D. If a cable is kinked, it shall not be installed.

E. Pull cable per manufacturer's installation instructions, in such a way as to prevent harmful stretching of the conductor, injury to the insulation or damage to the outer protective covering.

F. All cable ends shall be sealed with moisture-sealing tape before pulling, and shall be left sealed until connections are made.

G. Cable may be pulled by hand or by using a winch. Maximum allowable tension on fiber optic cable during pulling is 600 lbs.

H. The surface of the cable sheath or jacket may not be damaged to a depth of more than 1/10 of the thickness of the sheath nor flattened out of round by more than 1/10 of the outside diameter.

3.2 Specific Items of Work (HELIAX):

A. Install 16 runs of 7/8-inch Heliax cable from the exterior-mounted shelter RF enclosures to the tower platform-mounted enclosures. 8 runs of cable are to enter each of the tower enclosures. Length of run is approximately 150 feet.

B. Install strain relief bushings in lower surface of each tower mounted enclosure to accommodate the 7/8" Heliax. Leviton wire mesh type, or equivalent. Coordinate hole locations with the R.E., as the FAA will be installing antenna pigtails through the same surface of the enclosure, at a later date.

C. Leave service loop of 7/8" Heliax inside the tower handhole. See drawings for loop configuration.

D. Leave approximately three feet of excess length of each cable inside the new enclosures.

E. Perform cable testing prior to and after cable installation, in accordance with Section 3.4 of this specification

3.2 Specific Items of Work (Fiber Optic Cable):

A. Install both runs of fiber optic cable in the existing ductbank system extending from the base of the Air Traffic Control Tower to the manhole MH-R1 (located adjacent to the new RTR shelter), and continue through the newly constructed ductbank segment that will extend from MH-R1 to the new RTR equipment shelter. Approximate total length of fiber run is 5700 LF.

B. The ductbank segment from the ATCT crossing north under existing runway 8R/26L has several available conduits for placement of the new fiber cable. All other ductbank segments leading to the RTR site consist of 2-4" PVC conduits. In some of the segments there are only two 1-1/4" Innerducts in a single 4" PVC conduit that are currently not being utilized. In these segments Both new fiber cables should be installed within a single Innerduct. The remaining Innerduct must remain vacant in order to house ILS system fiber that will be installed at a later date.

C. Leave approximately 50 feet of service loop at each manhole.

D. At the ATCT manhole, coordinate with the R.E. for pulling the fibers into the ATCT building. There needs to be sufficient length of fiber to reach the top floor, plus allow 100 feet extra length of each cable.

E. At the new RTR equipment building, the new fiber cables will enter the building via conduit riser and LB. Leave approximately 50 feet of each fiber cable length extending inside the building.

3.4 Inspection by the Contractor:

A. Perform all cable inspection and testing in the presence of, and provide written results to the Contracting Officer's representative.

B. The contractor shall furnish all necessary test instruments, except where otherwise indicated. All instruments shall have been calibrated within a two-year period preceding cable testing by a laboratory approved by the measurement instrument manufacturer.

C. Prior to HELIAX cable installation the contractor shall measure the insulation and loop resistance of the cables per the requirements in FAA-C-1391b, 4.6.

1.) The insulation test (aka "Megger" check) shall be made between the center conductor and shield with a 500-volt DC instrument. Typical new cable should have an insulation resistance greater than 2000 Meg-ohms.

2.) The loop resistance test ("DC resistance" check) checks for opens and shall be made in the same way, but with the center conductors shorted to the shield at the far end of the cable. This test shall be made with a bridge, ohmmeter, or other suitable instrument. There should be a very low resistance measurement.

D. If the government-furnished cable fails to meet test requirements, the contractor shall not install the cable. The government will replace the defective cable.

C. After the cable is installed, but prior to termination and hookup by the FAA installation crew, the contractor shall repeat the cable tests and furnish results to the Contracting Officer's representative. If the cable fails to meet test requirements, the contractor shall replace the cable proven defective.

*****END OF SECTION*****

SECTION 016670

LIGHTNING PROTECTION, BONDING & GROUNDING

PART 1 GENERAL

1.1 General: The contractor shall provide all labor, equipment and materials as necessary to install lightning protection and grounding systems as specified on the drawings and in this specification. The contractor's work shall comply with all applicable sections of FAA-STD-019e, Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities. The major work items for this project are as follows:

1. Installation of 4/0 Earth Electrode System (EES) at each antenna tower.

2. Installation of 4/0 EES at RTR equipment shelter, with 4/0 tie to each tower EES.

3. Installation of Air Terminal assembly on platform of each tower, with grounding to tower underground counterpoise EES.

4. Installation of tower platform EES (halo) with down conductors tied to underground counterpoise.

5. Bonding of new cable wireway in shelter. Install #6 AWG green jacketed bonding jumpers between individual wireway sections, as well as between wireway and ground plate.

6. Grounding of building-mounted RF enclosures to building EES.

1.2 Applicable Documents: The following specifications and standards of the issues currently In force, form a part of this section, and are applicable as specified herein.

1.2.1 National Fire Protection Association (NFPA) Publications-

No. 70 National Electric Code, 2008.
No. 780 Standard for the Installation of Lightning Protection Systems

1.2.2 Underwriters' Laboratories

UL 96A Installation requirements for Lightning Protection Systems

1.2.3 Federal Aviation Administration

FAA STD 019e	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-C-1217f	Electrical Work, Interior

PART 2 MATERIALS

2.0 Materials: All materials shall be new, the standards products of manufacturer's regularly engaged in the production of such materials, and of the manufacturer's latest designs that comply with those shown on the drawings and as specified herein.

2.2 Grounding Conductors: The grounding electrode conductor shall have green colored insulation or be bare copper and sized as shown on the contract drawings. Where not shown, the conductor shall be sized in accordance with the National Electric Code except that it shall not be sized smaller than 6 AWG for bare conductors.

2.3 Bonding Jumpers: Bonding jumpers used in interior locations to bond sections of metal objects shall be insulated copper and sized in accordance with Table 250.133 of the NEC but not less than 6 AWG.

2.4 Other Hardware: Fasteners shall be of the same materials as the conductor base material or copper in most cases. Fasteners shall not be made of aluminum, galvanized steel or plated materials. Bonding devices, cable splicers and connectors shall be suitable for use with the installed conductor and be copper or bronze with bolt pressure connections.

PART 3 EXECUTION

3.0 Installation: The location of the grounding system for the facility shall be as indicated on the contract drawings, as specified in FAA STD 19e, as required by the applicable documents and as specified herein. In the event of conflicting requirements, the most stringent shall apply.

3.2 Grounding Connections: All equipment, armored cable, GRS conduit and all other exposed, non-current carrying metal parts of electrical equipment shall be grounded by an equipment grounding conductor sized as designated in the drawings and specifications, but in no case smaller than that required by Table 250-95 of the NEC. Bare conductors shall not be permitted except for where shown on the drawings. All connections to the equipment to be grounded shall be made with a ground connector specifically intended for that purpose. Connecting screws or mounting bolts are not suitable for use as grounding connections. Connections to ground electrodes and all other underground connections shall be exothermic welded.

3.3 Other Hardware: Install hardware in a neat manner, parallel or perpendicular or plumb where fastened to surfaces. Prior to bonding to surfaces, all connection points shall be cleaned of paint, insulation and other non-conducting materials over an area that extends at least ¼ inch beyond the bonding surface of the larger member.

3.4 Underground Connections: No part of the underground cable or connections shall be concealed until the Contracting Officer's Representative has inspected, tested and approved the ground rods or plates, conductors and connections in that part of the system. Any faulty connections or items shall be corrected or replaced as directed by the Contracting Officer's Representative.

3.5 Grounding Electrode Test: Contractor shall measure the earth electrode grounding resistance of the installed counterpoise. Test shall be the 3-point fall-of-potential measurement of the earth electrode system resistance and in accordance with FAA Specification 1217f, 5.3.6. The contractor shall record the test results and submit the report to the Contracting Officer's representative. The contractor shall notify the Contracting Officer's representative immediately if the resistance of any test is above 10 ohms.

*** * * END OF SECTION * * ***

APPENDIX

1. **GOVERNMENT FURNISHED MATERIALS (GFM)**
2. **FAR 77 AIRSPACE CASE DETERMINATION LETTERS**
3. **GEOTECHNICAL REPORT – KLEINFELDER, INC.**
4. **TOWER FABRICATION & ERECTION DOCUMENTS (To be provided separately)**
5. **RAM LADDER SAFETY RAIL SYSTEM DOCUMENTS**
6. **L-810 LED OBSTRUCTION LIGHT DOCUMENTATION**
7. **DRAWINGS**

GOVERNMENT FURNISHED MATERIALS (GFM)

PUEBLO, CO RTR (PUB)

ITEM	DESCRIPTION	QUANTITY
1	25-foot high lattice-steel antenna tower	3
2	18' x 22' Pre-fab equipment shelter	1
3	Tower and Shelter foundation designs	1 each
4	Anchor bolts and template for tower foundations	3 sets
5	RAM Ladder Safety Rail system	3 sets
6	7/8" Heliax cable	7500 LF
7	NEMA 4X Enclosure – 48"W x 36"H x 12" D	3
8	NEMA 4X Enclosure – 24" x 24" x 8"	6
9	L-810 LED Obstruction Light assembly	3
10	2-7/8" dia. Fibercast antenna masts – 5 ft. length	18

The government furnished materials will be stored at a location on the Pueblo, Colorado Memorial Airport. The address of the facility will be provided to the contractor no later than the preconstruction meeting.

DO NOT attempt to obtain entrance to the storage area to pick up materials from the storage compound without first contacting the Resident Engineer.

The contractor shall be responsible for picking up the above materials from the locked compound at the work center, transporting them to the job site, unloading and storing them at the job site, and for the installation. The contractor shall furnish all other materials.

Before accepting the materials, the contractor shall visually inspect the materials for omissions and defects. The contractor shall sign acceptance for the materials and be responsible for them until acceptance of the contract work.

Access and delivery dates shall be coordinated with the resident engineer.

The above materials have been inspected, accepted and adequate storage and protection will be maintained.

Received By: _____ Date: _____
(contractor)

Witnessed By: _____ Date: _____
(resident engineer)

U.S. Department
of Transportation

**Federal Aviation
Administration**

Denver Airports District Office
26805 East 68th Ave., Suite 224
Denver, CO 80249-6361
(303) 342-1250

September 22, 2011

Mr. Michael Calhoon
FAA Engineering Services
AJW-W13B
1601 Lind Ave., S.W.
Renton, Washington 98057

Dear Mr. Calhoon:

Airspace Case No. 2011-ANM-516-NRA

An Aviation Impact Analysis has been completed for the proposed FAA Mobile Communications Van (MCV) located on Pueblo Memorial Airport, Pueblo, Colorado, as submitted on FAA Form 7460-1. Based on this analysis, we have no objection to the proposal; it will not adversely affect the safe and efficient use of airspace by aircraft.

If any changes are made to this proposal (e.g., increase in height or dimensions, change in location, coordinates, frequencies, etc.) a new 7460-1 submittal will be required.

This is an aeronautical determination issued in accordance with FAR, Part 77, concerning the effect of this proposal on the safe and efficient use of the navigable airspace by aircraft. This determination does not relieve the sponsor of any compliance responsibilities relating to any other law, ordinance, or regulation of any Federal, state, or local governmental body.

If you have any questions concerning this determination, please contact me at (303) 342-1251.

Sincerely,

Marsha Hofer

Marsha Hofer
Program Specialist

cc:
Manager, Pueblo Memorial Airport

U.S. Department
of Transportation

**Federal Aviation
Administration**

Denver Airports District Office
26805 East 68th Ave., Suite 224
Denver, CO 80249-6361
(303) 342-1250

September 22, 2011

Mr. Michael Calhoon
FAA Engineering Services
AJW-W13B
1601 Lind Ave., S.W.
Renton, Washington 98057

Dear Mr. Calhoon:

Airspace Case No. 2011-ANM-517-NRA

An Aviation Impact Analysis has been completed for the proposed 100' temporary construction crane (construction of FAA RTR facility) located on Pueblo Memorial Airport, Pueblo, Colorado, as submitted on FAA Form 7460-1. Based on this analysis, we have no objection to the proposal; it will not adversely affect the safe and efficient use of airspace by aircraft.

Because of the proximity of the crane to active airport operations areas, it will be necessary to mark and light the crane in accordance with FAA Advisory Circular 70/7460-1; lower it at night, when not in use, or at the request of the Air Traffic Control Tower (ATCT), and to contact the ATCT prior to erecting the crane.

If any changes are made to this proposal (e.g., increase in height or dimensions, change in location, coordinates, frequencies, etc.) a new 7460-1 submittal will be required.

This is an aeronautical determination issued in accordance with FAR, Part 77, concerning the effect of this proposal on the safe and efficient use of the navigable airspace by aircraft. This determination does not relieve the sponsor of any compliance responsibilities relating to any other law, ordinance, or regulation of any Federal, state, or local governmental body.

If you have any questions concerning this determination, please contact me at (303) 342-1251.

Sincerely,

Marsha Hofer

Marsha Hofer
Program Specialist

cc:
Manager, Pueblo Memorial Airport

U.S. Department
of Transportation

**Federal Aviation
Administration**

Denver Airports District Office
26805 East 68th Ave., Suite 224
Denver, CO 80249-6361
(303) 342-1250

September 22, 2011

Mr. Michael Calhoon
FAA Engineering Services
AJW-W13B
1601 Lind Ave., S.W.
Renton, Washington 98057

Dear Mr. Calhoon:

Airspace Case No. 2011-ANM-518-NRA

An Aviation Impact Analysis has been completed for the proposed FAA RTR facility located on Pueblo Memorial Airport, Pueblo, Colorado, as submitted on FAA Form 7460-1. Based on this analysis, we have no objection to the proposal; it will not adversely affect the safe and efficient use of airspace by aircraft.

Buildings must be outside any existing or future taxiway/taxilane safety areas or object free areas.

If any changes are made to this proposal (e.g., increase in height or dimensions, change in location, coordinates, frequencies, etc.) a new 7460-1 submittal will be required.

This is an aeronautical determination issued in accordance with FAR, Part 77, concerning the effect of this proposal on the safe and efficient use of the navigable airspace by aircraft. This determination does not relieve the sponsor of any compliance responsibilities relating to any other law, ordinance, or regulation of any Federal, state, or local governmental body.

If you have any questions concerning this determination, please contact me at (303) 342-1251.

This construction should be shown on the next regular ALP update.

Sincerely,

Marsha Hofer
Program Specialist

cc:
Manager, Pueblo Memorial Airport

GEOTECHNICAL ENGINEERING REPORT

KLEINFELDER, INC.

MARCH 23, 2012

KLEINFELDER
Bright People. Right Solutions.

GEOTECHNICAL ENGINEERING REPORT
PROPOSED RTR SITE RELOCATION
PUEBLO MEMORIAL AIRPORT
PUEBLO, COLORADO

Prepared by:

Brysen T. Mustain, PG
Engineering Geologist

William J. Barreire, PE
Senior Geotechnical Engineer

COLORADO REGISTERED
WILLIAM J. BARREIRE
32045
PROFESSIONAL ENGINEER
3/23/12

March 23, 2012
Kleinfelder Project Number: 125311

Kleinfelder
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March 23, 2012

Federal Aviation Administration
1601 LND Avenue SW
Renton, WA 98057

Attention: Mr. Maximo Flores

Subject: Geotechnical Engineering Report
Proposed RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

Mr. Flores:

The attached report presents the results of Kleinfelder's Geotechnical Engineering Investigation for the Proposed RTR Site Relocation at the Pueblo Memorial Airport located in Pueblo, Colorado. Our work consisted of a subsurface exploration program, laboratory testing, engineering analyses, and preparation of this report.

We appreciate this opportunity to be of service to you, and look forward to future endeavors. If you have any questions regarding this report or need additional information or services, please contact our office at (719) 632-3593.

Respectfully submitted,

KLEINFELDER WEST, INC.

Brysen T. Mustain, PG
Engineering Geologist

William J. Barreire, PE
Senior Geotechnical Engineer

BTM/WJB/btm
Enclosures

KLEINFELDER
Bright People. Right Solutions.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 GENERAL

This report presents the results of Kleinfelder's Geotechnical Engineering Investigation performed for the proposed RTR Site Relocation at the Pueblo Memorial Airport in Pueblo, Colorado. An attached Vicinity Map (Plate A-1) shows the general location of the project. Our investigation was performed for the Federal Aviation Administration (FAA) and was authorized by Mr. Maximo Flores.

The report includes our understanding of the proposed construction and our recommendations relating to the geotechnical aspects of project design and construction. The conclusions and recommendations stated in this report are based upon the subsurface conditions found at the locations of our exploratory borings at the time our exploration was performed. They also are subject to the provisions stated in the report sections titled **Additional Services** and **Limitations**. Our findings, conclusions, and recommendations should not be extrapolated to other areas or used for other projects without our prior review. Furthermore, they should not be used if the site has been altered, or if a prolonged period has elapsed since the date of the report, without Kleinfelder's prior review to determine if they remain valid.

1.2 PROJECT DESCRIPTION

We understand the project will comprise the construction of three (3) communication towers and a small control building on a 25,600 square feet (SF) site. The towers are to be 25-feet in height and will be lattice-type construction. The control building is planned to be a pre-manufactured structure covering approximately 18-feet by 24-feet. We understand the control building will be one story and may have masonry walls with a truss-type roof.

We anticipate additional construction activities will include general site grading, which we assume will be limited to providing proper drainage away from the proposed structures and site improvements, preparing the foundation excavations, and installation of utilities.

1.3 PURPOSE AND SCOPE

The purpose of our investigation was to explore and evaluate subsurface conditions at various locations on the site and, based upon the conditions found, to develop recommendations relating to the geotechnical aspects of project design and construction. Our conclusions and recommendations in this report are based upon analysis of the data from our field exploration, laboratory tests, and our experience with similar soil and geologic conditions in the area.

Kleinfelder's scope of services included:

- A visual reconnaissance to observe surface and geologic conditions at the project site and locating the exploratory borings;
- Notification of the Federal Aviation Administration, Pueblo Memorial Airport, and the Utility Notification Center of Colorado (UNCC) for location of underground utilities;
- The drilling of a total of four (4) exploratory borings within the proposed RTR Site footprint;
- Laboratory testing of selected samples obtained during the field exploration to evaluate relevant physical, and engineering properties of the soil;
- Evaluation and engineering analyses of the field and laboratory data collected to develop our geotechnical conclusions and recommendations; and
- Preparation of this report, which includes a description of the proposed project, a description of the surface and subsurface site conditions found during our investigation, our conclusions and recommendations as to tower/building foundation and floor slab design and construction, other related geotechnical issues, and appendices which summarize our field and laboratory investigations.

2 FIELD EXPLORATION AND LABORATORY TESTING

2.1 FIELD EXPLORATION

Our field exploration program was performed on February 8, 2012 and included drilling the following:

Table 1 – Summary of Field Exploration Program

Location	Boring Designation	Approximate Depths of Total Exploration [feet, bgs]*
Proposed Control Building Footprint	B-1	24
Proposed Tower Locations	B-2	24
	B-3	24
	B-4	24

*All depths referenced to existing ground surface.

The boring locations are indicated on the attached Boring Location Plan in Plate A-1. The exploratory borings were advanced using a truck-mounted CME-45 drill rig equipped with 4-inch outside-diameter, continuous-flight, solid-stem augers. Subsurface soil samples were obtained during exploration using a modified California sampler (2.5-inch I.D.) and standard split-spoon sampler (1.375-inch I.D.) driven into the strata, with blows from a 140-pound hammer falling through a 30-inch drop. The blows required to drive the sampler in six-inch increments into the strata are recorded on the logs. These blow counts are an indication of the relative density or consistency of the strata.

Appendix B to this report includes individual boring logs describing the subsurface conditions encountered. The lines defining boundaries between soil and rock types on the logs are based on drill rig behavior and interpolation between samples, and are therefore approximate. Transition between soil and rock types may be abrupt or may be gradual.

2.2 LABORATORY TESTING

2.2.1 Geotechnical Laboratory Testing

Laboratory tests were performed on selected soil samples to estimate their relative engineering properties. Tests were performed in general accordance with the local practice, ASTM or other recognized standards-setting bodies and included:

- Description and Identification of Soils (Visual-Manual Procedure);
- Classification of Soils for Engineering Purposes;
- One-Dimensional Swell/Settlement Potential;
- Standard Test Method for Particle-Size Analysis of Soils, and;
- Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

Results of the laboratory tests are included in Appendix C. Selected test results are also shown on the boring logs contained in Appendix B.

3 SITE CONDITIONS

3.1 SURFACE

At the time of our exploration, the subject site comprised a flat to very gently sloping undeveloped area comprising bare earth, weeds, sage, and cacti on the north side of the Pueblo Memorial Airport. The site is bounded by Pueblo Memorial Airport runways and taxiways to the south, east, and west, and undeveloped ground to the north. Other existing airport and industrial buildings were present to the south.

3.2 GEOLOGY

Prior to drilling, the geology of the site was evaluated by reviewing published geologic maps, including the USGS Geologic Map of the Pueblo 1° by 2° Quadrangle, south-central Colorado (Scott, Taylor, Epis, & Wobus, 1978). The mapping indicates that the overburden or alluvial layer consists chiefly of clayey sand to sandy lean clay deposits. The mapping also indicates the bedrock underlying the proposed site consists of the interbedded shale and claystone of the Pierre Shale Formation. Samples collected during the subsurface investigation generally concur with the published geologic mapping.

3.2.1 Seismicity

Based upon the geologic setting, subsurface soil conditions, and low seismic activity in this region, liquefaction is not expected to be a hazard at the site. The subsurface soil profiles correspond with Site Class C of the 2009 International Building Code (IBC). We recommend the following site coefficients be used at this site.

Table 2 – Design Acceleration for Short Periods

S_S	F_a	S_{MS} ($S_{MS} = F_a S_s$)	S_{DS} ($S_{DS} = 2/3\ S_{MS}$)
0.186	1.2	0.223	0.149

S_S = The mapped spectral accelerations for short periods (U.S. Geological Survey Web Page, 2012)
F_a = Site coefficient from Table 1613.5.3(1), 2009 IBC
S_{MS} = The maximum considered earthquake spectral response accelerations for short periods
S_{DS} = 5-percent damped design spectral response acceleration at short periods

Table 3 – Design Acceleration for 1-Second Period

S_1	F_v	S_{M1} ($S_{M1} = F_v S_1$)	S_{D1} ($S_{D1} = 2/3\ S_{M1}$)
0.058	1.7	0.099	0.066

S_1 = The mapped spectral accelerations for 1-second period (U.S. Geological Survey Web Page, 2012)
F_v = Site coefficient from Table 1613.5.3(2), 2009 IBC
S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period
S_{D1} = 5-percent damped design spectral response acceleration at 1-second period

3.3 SUBSURFACE

Based on the conditions encountered during our field exploration, we characterized the subsurface and developed the general stratigraphic profile described below:

Table 4 - Summary of Geologic Units

Geologic Unit	Ranges of Soil/ Rock Type	Borings Encountered	Depths Encountered [Feet](1)	Color	Moisture	Density
Colluvium	Lean CLAY (CL)	B-1	0 to 1	Brown	Slightly Moist to Dry	Firm
		B-2	0 to 1½			
		B-3	0 to 1½			
		B-4	0 to 2			
Pierre Shale Formation	Claystone/ Shale	B-1	1 to BOH(2)	Dark Gray	Slightly Moist	Hard to Very Hard
		B-2	1½ to BOH(2)			
		B-3	1½ to BOH(2)			
		B-4	2 to BOH(2)			

(1) All depths referenced to below existing ground surface.
(2) BOH = Bottom of Hole.

Laboratory testing indicated that a portion of the subsurface materials encountered have a very high swell potential. Swell/consolidation testing showed volume change upon inundation ranging from 5.6 to 11.8 percent and swell pressures above 10,000 pounds per square foot (psf) in some cases. The boring logs contained in Appendix B and the laboratory test results contained in Appendix C of this report should be reviewed for more detailed descriptions of the subsurface conditions at each of the boring locations explored.

3.4 GROUNDWATER

Groundwater was not encountered in any of our borings at the time of drilling. It should be noted that soil moisture levels and groundwater levels commonly vary over time and space depending upon seasonal precipitation, irrigation practices, land use and runoff conditions.

Based on our experience, it is not uncommon to find groundwater at sporadic locations and elevations in joints and fractures within the Pierre Shale Formation. It is also considered possible that a shallow, perched groundwater condition may also develop at this site at the contact between soil and bedrock during wetter periods or seasons. Accordingly, the soil moisture and groundwater data in this report pertain only to the locations and times at which exploration was performed. They can be extrapolated to other locations and times only with caution. It should be noted that Kleinfelder has not performed a hydrologic study to assess the seasonal groundwater conditions.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 GEOTECHNICAL FEASIBILITY OF PROPOSED CONSTRUCTION

Kleinfelder found no subsurface conditions during this investigation that would preclude development of the site essentially as planned, provided that the recommendations in this report are incorporated in the design and construction of the project.

Based on laboratory test results the subsurface soil and rock are highly expansive. A significant potential for damage exists for structures founded directly on these materials. Additionally, lightly-loaded floor slabs founded directly on the existing expansive materials would be subject to excessive differential movements. We estimate potential movements of slabs-on-grade constructed on the native expansive soils could experience vertical movement associated with heave on the order of 6- to 10-inches. Differential movement may be as great as total movement. The expansive characteristics of the site soils will dictate the type of foundation and floor slab construction most suitable for the proposed project, as outlined below. We do not recommend shallow foundations nor slab-on-grade floor construction methods be utilized at this site.

4.1.1 Drilled Pier Foundation and Floor Slabs

In order to mitigate the potential risk of structure damage due to swelling of subsurface soils and bedrock, **we recommend that both the proposed control building and communications towers be supported on a straight-shaft drilled pier foundation system.** Additionally, we recommend a structurally-supported floor system for the control building with a crawl-space or void under the floor to physically separate the superstructure from the expansive subgrade. In this case, the system floor would be supported on grade beams and drilled piers with a void space underneath both the grade beams as well as the floor, therefore not in direct contact with the expansive site soils. Utility lines should be provided with flexible joints or oversized sleeves where they penetrate floor slabs and are in contact with the soils to prevent breakage caused by differential slab movement.

Our geotechnical design and construction recommendations for site preparation, foundations, floor systems and other related construction topics are provided in the following sections.

4.2 CONSTRUCTION CONSIDERATIONS

4.2.1 Site Preparation and Grading

All site preparation and earthwork operations should be performed in accordance with applicable codes, safety regulations and other Local, State or Federal guidelines.

Initial site work should consist of stripping all vegetation and other deleterious materials from all areas to be filled and areas to be cut. All of the vegetative and deleterious material should be removed for offsite disposal in accordance with local laws and regulations or, if appropriate, stockpiled in proposed landscaped areas for future use. Areas to receive fill should be evaluated by the geotechnical engineer prior to the placement of any fill materials.

After performing the required excavations and prior to the placement of any new fill, processing of the subgrade soils should be performed. All fill material should be placed on a horizontal plane and placed in loose lifts not to exceed 8-inches in thickness, unless otherwise accepted by the geotechnical engineer. Where the excavation elevation for the floor slab or foundation elements encounters bedrock, the bedrock should be scraped clean and free of loose rock fragments prior to placement of structural fill.

4.2.2 Excavation Characteristics

A drilling rig for excavation of the drilled piers of sufficient size to penetrate the very hard Pierre Shale Formation bedrock the required amount should be mobilized. We believe that excavation into the bedrock will range from moderately hard for more weathered zones to extremely difficult for harder zones (blowcounts of 50/6" or greater).

Excavation equipment such as heavy-duty backhoes suitable for rock excavation, hoe rams, dozers equipped with rock excavating teeth/rippers and similar equipment will be required to excavate into bedrock materials. We anticipate excavation in the harder materials could be relatively slow depending on the depth of excavation, the type of bedrock encountered, the type and size of equipment used, as well as the contractor's experience with similar excavation. Blasting is not expected to be required unless excavation with equipment becomes inefficient from a cost/time standpoint.

All excavations must comply with the applicable Local, State, and Federal safety regulations, and particularly with the excavation standards of the Occupational Safety and Health Administration (OSHA). Construction site safety, including excavation safety, is the sole responsibility of the Contractor as part of its overall responsibility for the means, methods and sequencing of construction operations. Kleinfelder's recommendations for excavation support are intended for the Client's use in planning the project, and in no way relieve the Contractor of its responsibility to construct, support and maintain safe slopes. Under no circumstances should the following recommendations be interpreted to mean that Kleinfelder is assuming responsibility for either construction site safety or the Contractor's activities.

We believe that the very hard and intact on-site claystone/shale bedrock may be classified as Type A material. OSHA requires that unsupported cuts up to 20-feet in height be laid back to ratios no steeper than ¾H:1V (horizontal to vertical) for a Type A material. In general, we

believe that these slope ratios will be temporarily stable under unsaturated conditions. If water infiltration occurs, flatter slopes may be appropriate. Please note that the actual determination of soil type and allowable sloping must be made in the field by an OSHA-qualified "competent person."

4.2.3 Import Structural Fill Specifications

The on-site soils and bedrock are not suitable for use as structural fill beneath the proposed site improvements. In addition, care should be taken when utilizing a granular structural fill as water can more readily penetrate this more permeable fill and pool upon the expansive soil/bedrock surface exacerbating the swell potential. Imported material, if required, should consist of a non-expansive material meeting the following criteria:

Table 5 – Imported Structural Fill Criteria

Gradation Requirements	
Standard Sieve Size	Percent Passing
2-inch	100
No. 200	10-30
Plasticity Requirements (Atterberg Limits)	
Liquid Limit	30 or less
Plasticity Index	10 or less

Prior to placement of the fill, it should be moisture conditioned as described in this report. A sample of any imported fill material should be submitted to our office for approval and testing at least one week prior to stockpiling at the site. Structural fill should be compacted according to the recommendations in Section 4.2.5 of this report.

4.2.4 Utility Trench Backfill

Backfill material should be essentially free of plant matter, organic soil, debris, trash, other deleterious matter and rock particles larger than 2-inches and may comprise the on-site soils. However, backfill material in the "pipe zone" (from the trench floor to 1-foot above the top of pipe) should not contain rock particles larger than 1-inch. Strictly observe any requirements specified by the utility agency for bedding and pipe-zone fill. In general, backfill above the pipe zone in utility trenches should be placed in lifts of 6- to 8-inches, and compacted using power equipment designed for trench work. Compact trench backfill as recommended in Section 4.2.5 of this report.

4.2.5 Compaction Requirements

Fill materials should be compacted to the following:

Table 6 - Compaction Specifications

Fill Location	Material Type	Percent Compaction[1]	Moisture Content
Structural Fill	Import Structural Fill[2]	98 minimum (ASTM D 698)	-2% to +2% of optimum
Utility Trenches	On-Site Soil/Import Structural Fill[2]	95 minimum (ASTM D 698)	-2% to +2% of optimum

1) *Where two or more fill locations coincide, the more stringent compaction recommendations shall be utilized.*
2) *See comments in Section 4.2.3 regarding use of more permeable structural fill on this site.*

4.2.6 Construction in Wet or Cold Weather

During construction, grade the site such that surface water can drain readily away from the structural areas. Promptly pump out or otherwise remove any water that may accumulate in excavations or on subgrade surfaces, and allow these areas to dry before resuming construction. The use of berms, ditches, and similar means may be used to prevent stormwater from entering the work area and to convey any water off-site efficiently.

If earthwork is performed during the winter months when freezing is a factor, no grading fill, structural fill or other fill should be placed on frosted or frozen ground, nor should frozen material be placed as fill. Frozen ground should be allowed to thaw or be completely removed prior to placement of fill. A good practice is to cover the compacted fill with a “blanket” of loose fill to help prevent the compacted fill from freezing.

If the structure is erected during cold weather, foundations or other concrete elements should not be constructed on frozen soil. Frozen soil should be completely removed from beneath the concrete elements, or thawed, scarified and re-compacted. The amount of time passing between excavation or subgrade preparation and placing concrete should be minimized during freezing conditions to prevent the prepared soils from freezing. Blankets, soil cover or heating as required may be utilized to prevent the subgrade from freezing.

4.2.7 Construction Testing and Observation

Testing and construction observation should take place under the direction of Kleinfelder to support our professional opinion as to whether the earthwork does or does not substantially conform to the recommendations in this report. Furthermore, the opinions and conclusions of a geotechnical report are based upon the interpretation of a limited amount of information obtained from the field exploration. It is therefore not uncommon to find that actual site

conditions differ somewhat from those indicated in the report. Kleinfelder should remain involved throughout the project to evaluate such differing conditions as they appear, and to modify or add to the geotechnical recommendations as necessary.

4.2.8 Surface Drainage and Landscaping

Positive drainage away from the structures is paramount to the performance of foundations and flatwork, and should be provided during the life of the structures. Surface drainage should be created such that water is diverted off the site and away from backfill areas of adjacent structures. Landscape areas within 10-feet of the structure should slope away at a minimum of 8 percent. Areas where pavements or slabs are constructed adjacent to the structure should slope away at a minimum grade of 2 percent. All downspouts from roof drains should direct water well away from all structures. Landscaping improvements that require supplemental watering must not be utilized near improved areas including foundations, pavements or slabs.

4.2.9 Permanent Cut and Fill Slopes

Permanent cut and fill slopes exposing the materials encountered in our borings are anticipated to be stable at slope ratios as steep as 3H:1V under dry conditions. New slopes should be re-vegetated as soon as possible after completion to reduce erosion problems.

4.3 DEEP FOUNDATION SYSTEM RECOMMENDATIONS

Due to presence of highly expansive bedrock on this site at the proposed foundation elevations, it is recommended that both the proposed communication towers and control building structure be supported on a deep foundation system consisting of straight-shaft drilled piers bottomed within the underlying **BEDROCK**. For the purposes of this report, **BEDROCK** is defined as the zone of relatively unweathered claystone or shale bedrock material that is considered appropriate for "socketing" the piers to achieve the end bearing and skin friction criteria presented below, as well as providing proper "anchorage" of the lower portion of the pier against uplift forces due to expansive soils and claystone. This zone of **BEDROCK** is depicted by the lower portions of the boring logs labeled as "*Pierre Shale Formational Bedrock*" presented in Appendix B, attached to this report. The following provides our design and construction recommendations for a drilled pier foundation system. These recommendations assume pier diameters of approximately 18- to 30-inches will be utilized.

4.3.1 Drilled Pier Recommendations

- For compressive loading, piers should be designed for a maximum allowable end bearing pressure of 50,000 pounds per square foot (psf) and a skin friction value of 5,000 psf, for the portion of pier in contact with the underlying **BEDROCK**. Skin friction in soil or fill materials or within 5-feet below bottom of grade beams should be ignored.

- In order to resist uplift forces due to the expansive bedrock, we recommend piers have a minimum "drilled" length of 20-feet. Final pier depths should be determined by the geotechnical engineer in the field at the time of construction.
- Calculations for additional uplift resistance due to overturning forces should be based upon an uplift skin friction value of two-thirds of the compressive side friction for the portion of pier within the **BEDROCK** strata and below 5-feet from bottom of grade beams, which equates to 3,333 psf.
- To resist lateral loads, we recommend designing the piers considering a lateral subgrade modulus of 600 kips per cubic foot (kcf) for the **BEDROCK** penetration. Lateral soil resistance within the upper 5-feet of the drilled portion of the pier should be ignored.
- Piers should be designed by a qualified structural engineer. Piers should be reinforced their full length. As a minimum, we recommend the cross-sectional area of reinforcement be equal to at least 1.0 percent of the gross cross-sectional area of the pier to help resist tensile forces due to expansive soils. This percentage may vary for pier diameters other than that assumed above, of 18- to 30-inches. Grade 60 steel should be used. Reinforcement should extend into grade beams or foundation walls.
- For the control building, provide at least a 10-inch continuous void beneath grade beams (between piers) to concentrate building deadloads and isolate the superstructure from underlying expansive soils.

4.3.2 Pier Construction Considerations

We recommend the pier drilling contractor be familiar and experienced with pier drilling operations in this area. The construction criteria presented below should be observed for a straight-shaft drilled pier foundation system. The construction details should be considered when preparing project documents.

- Drilling operations should produce a pier hole exposing relatively undisturbed bedrock. Remolded materials on pier walls must be removed.
- **Due to the presence of expansive materials at this site, care should be taken to ensure that the drilled piers are not oversized at the top as this provides area for the expansive materials to exert significant force to the foundation. The upper portion of the pier should be formed with a sonotube to maintain a uniform diameter. The sonotube should be placed prior to pouring the upper portion of the pier.**
- Concrete used in the drilled piers should be a fluid mix with a slump in the range of 4- to 6-inches to properly consolidate in pier holes.

- Drilled pier holes should be properly cleaned prior to placement of concrete. Concrete should be placed in drilled piers immediately after drilling to reduce the risk of contamination from ground water or other sources.
- Groundwater was not encountered during our investigation and we do not anticipate casing and dewatering of pier holes will be necessary. In no case should concrete be placed in more than 3-inches of water unless concrete is placed from the bottom of the hole using a pump truck with nozzle extension and the hole has been properly cleaned.
- Kleinfelder should observe installation of the drilled piers on a full-time basis to check that the appropriate length and bearing stratum is being penetrated and to monitor other pier construction procedures.

4.4 CONCRETE FLOOR SLAB CONSTRUCTION RECOMMENDATIONS

4.4.1 Structural Floor System

Due to the highly expansive near surface materials encountered in our borings, we recommend utilizing a structurally-supported floor system for the control building with a crawl-space or void under the floor to physically separate the superstructure from the highly expansive subgrade. In this case, floor slab would be supported on voided grade beams and drilled piers. We recommend a minimum clear space between any part of the underside of the floor system and the exposed earth of at least 12-inches. There have been occasional problems with cast-on-void floor system designs when the cardboard void form has not degraded, which resulted in uplift of the floor when the underlying soils have swelled. The void form should be designed to have the minimum strength required to support the concrete until cure, and then break down quickly afterward. We recommend against the use of void forms that can delay but not prevent moistening of the void form. The use of a gravel bed under the void form is also discouraged because the gravel can act as a capillary break, preventing moisture transmission from soil to the void form.

4.5 CONCRETE TYPE

Soils with high levels of soluble sulfates were encountered during this investigation. Based on our experience with these types of soils, in lieu of utilizing Type V cement (Type V being considered a sulfate resistant cement), locally available Type II or Type I-II cement with a pozzolon additive consisting of Class F fly ash as an alternative may be considered. Some of the more pertinent mix requirements that must be adhered to in order to maximize sulfate resistance are as follows:

- Mix should contain no less that 15 percent and no greater that 35 percent Class F fly ash (20 percent fly ash is a common target), and;
- At placement, the water to cement ratio should not be greater than 0.45.

5 ADDITIONAL SERVICES

5.1 REQUIREMENTS FOR ADDITIONAL SERVICES

In most cases, other services beyond completion of a geotechnical report are necessary or desirable to complete a project satisfactorily. It also sometimes happens that, while performing our services, we discover conditions or circumstances that require the performance of additional work that was not anticipated when the geotechnical report was written. Kleinfelder offers a range of environmental, geological, geotechnical, and construction services to suit the varying needs of our clients. This section outlines some of those services that may pertain to this project. Kleinfelder will be happy to submit a proposal for performing any such services upon request.

5.2 REVIEW OF PLANS AND SPECIFICATIONS

We strongly recommend that Kleinfelder be given an opportunity to review the plans and specifications for this project before they are finalized. Such a review allows us to verify that our recommendations and concerns have been adequately incorporated in the design. It also gives us an opportunity to discuss those recommendations and concerns with other members of the design team so that we can clear up misunderstandings or ambiguities before the project reaches the construction stage.

5.3 PRE-CONSTRUCTION MEETINGS

We recommend that the Owner, the Contractor, and the other members of the design team hold a pre-construction meeting with Kleinfelder's project engineer. The purpose of this meeting is to go over geotechnical aspects of the project so that all parties have a clear understanding of the geotechnical issues that affect the Contractor's work and how they will be handled. The meeting also allows us to set up the communication and coordination needed for construction observation and testing, and to identify points of confusion or disagreement that need to be resolved.

5.4 CONSTRUCTION OBSERVATION AND TESTING

The recommendations in this report depend on the assumption that an adequate program of testing and observation will be made during construction to verify compliance with our recommendations. These tests and observations may include, but not necessarily be limited to, the following:

- Observations and density testing during site preparation and earthwork;
- Observation of foundation excavations and foundation installation;
- Observation and testing of construction materials; and
- Consultation as may be required during construction.

Adequate testing and observation is essential to successful and economical completion of a construction project. Testing and observation allow us to verify that our recommendations are being followed. They also make it possible to identify new or changed conditions that require us to modify those recommendations. Construction testing and observation should be scheduled in advance so that our personnel can plan to be available for the work. It is also desirable that we receive a set of project plans and specifications at the time our work is first scheduled.

6 LIMITATIONS

The recommendations in this report are based on our field observations, laboratory testing, and our present understanding of the proposed construction. It is possible that subsurface conditions can vary between or beyond the points explored. If the conditions found during construction differ from those described in this report, please notify us immediately so that we can review our report in light of those conditions and provide supplemental recommendations as necessary. We should also review the report if the scope of the proposed construction, including the proposed loads or structure locations, changes from that described in this report.

Kleinfelder has prepared this report for the exclusive use of the Federal Aviation Administration for the proposed RTR Site Relocation to be constructed at the Pueblo Memorial Airport in Pueblo, Colorado. The report was prepared in substantial accordance with the generally accepted standards of practice for geotechnical engineering as exist in the site area at the time of our investigation. No warranty is expressed or implied. The recommendations in this report are based on the assumption that Kleinfelder will be provided review comments and additional information as required to revise/refine recommendations. They also are based on the assumption that Kleinfelder will be retained to conduct an adequate program of construction testing and observation to evaluate compliance with our recommendations.

This report may be used only by the Client, and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land use, site conditions (both on- and off-site), or other factors may change over time, so that additional investigation or revision of our recommendations may be required with the passage of time. It is the Client's responsibility to see that all parties to the project including the designer, contractor, and subcontractors, are made aware of this report in its entirety. The use of information contained in this report for bidding purposes shall be at the Contractor's option and risk. Any party other than the Client who wishes to use this report must notify Kleinfelder of such intended use. Based on that intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Noncompliance with these requirements by the Client or anyone else will release Kleinfelder from any liability resulting from the use of this report by an unauthorized party.

APPENDIX A

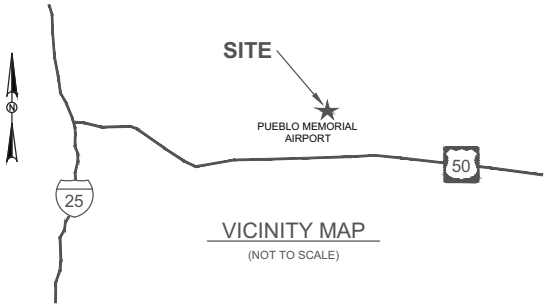
Vicinity Map and Boring Location Plan

0 1000 2000 4000

APPROXIMATE SCALE IN FEET

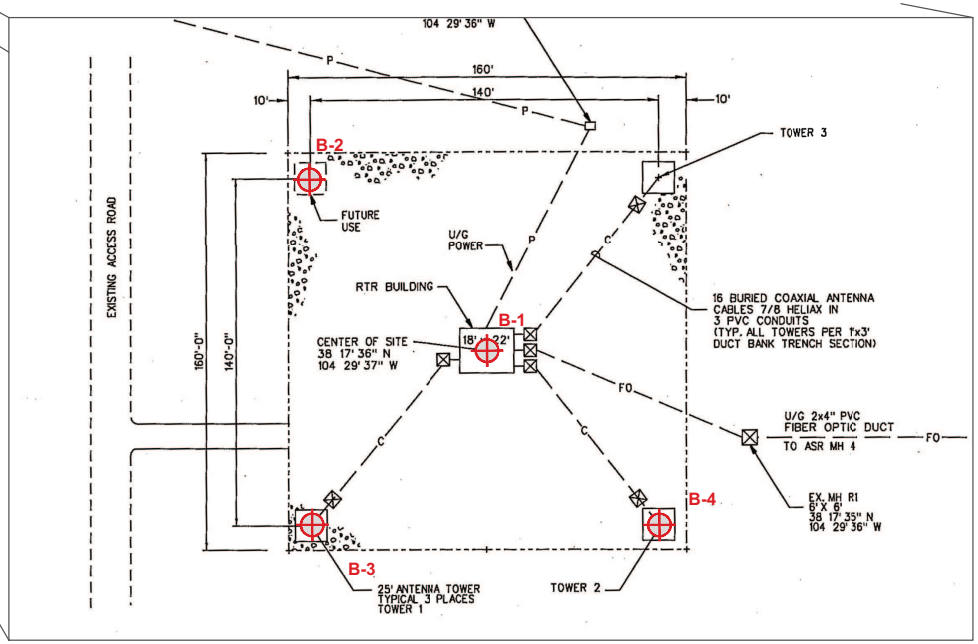
NOTE:
BASE IMAGE WAS OBTAINED FROM ESRI ARCGIS, 2008
MICROSOFT CORPORATION

SITE PLAN PROVIDED BY THE FAA ON DECEMBER 27, 2011



VICINITY MAP

(NOT TO SCALE)



(NOT TO SCALE)

LEGEND:

B-1 BORING DESIGNATION AND APPROXIMATE LOCATION.

KLEINFELDER
Bright People. Right Solutions.
4815 List Drive, Unit 115
Colorado Springs, Colorado 80919
PH. 719-632-3593 FAX. 719-632-2648

Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	February, 2012
File Name:	125311_geo_cad.dwg

VICINITY MAP AND BORING LOCATION PLAN

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

PLATE

A-1

APPENDIX B

Logs of Exploratory Borings

Boring Location:	See Boring Location Plan	Drill Company:	Custom Auger Drilling	Auger Diameter:	4 inches
Date Started:	February 8, 2012	Drill Equipment:	CME-45	Sampling Method:	SPT & MCAL
Date Completed:	February 8, 2012	Drilling Method:	Solid Stem Auger	Hammer Type:	140 lb. Cathead
Logged By:	L. Frank			Hammer Drop:	30 inches

Depth (feet)	Graphical Log	DESCRIPTION	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Sample Type	LABORATORY: ASTM Symbol	LABORATORY: Moisture Content (%)	LABORATORY: Dry Density (pcf)	LABORATORY: Liquid Limit (NV=No Value)	LABORATORY: Plasticity Index (NP=No Plasticity)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests/ Remarks
		Surface Condition: Bare Earth and Straw										
		Colluvium Lean CLAY (CL), brown, dry to moist, firm, claystone fragments present										
		Pierre Shale Formational Bedrock CLAYSTONE TO SHALE BEDROCK, dark gray, dry, very hard, gypsum in partings and joints		50/3"	MCAL	CL	9.4		39	20	99	
5				50/4"	SPT		9.0					
10				50/2"	SPT		6.5					
15				50/2"	SPT		6.2					
20				50/1"	SPT		6.9					
25				50/1"	SPT		7.6					
30												

NOTES:
Boring terminated at approximately 24-feet below ground surface.
Boring was backfilled with auger cuttings on February 08, 2012.
Groundwater was not encountered during drilling.

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Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

BORING LOG

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

BORING
B-1

Boring Location:	See Boring Location Plan	Drill Company:	Custom Auger Drilling	Auger Diameter:	4 inches
Date Started:	February 8, 2012	Drill Equipment:	CME-45	Sampling Method:	SPT & MCAL
Date Completed:	February 8, 2012	Drilling Method:	Solid Stem Auger	Hammer Type:	140 lb. Automatic
Logged By:	L. Frank			Hammer Drop:	30 inches

Depth (feet)	Graphical Log	DESCRIPTION	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Sample Type	LABORATORY: ASTM Symbol	LABORATORY: Moisture Content (%)	LABORATORY: Dry Density (pcf)	LABORATORY: Liquid Limit (NV=No Value)	LABORATORY: Plasticity Index (NP=No Plasticity)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests/ Remarks
		Surface Condition: Bare Earth and Straw										
		Colluvium Lean CLAY (CL), brown, dry to moist, firm, claystone fragments and sulfates present										
		Pierre Shale Formational Bedrock CLAYSTONE TO SHALE BEDROCK, dark gray, dry, very hard, sulfates present		50/3"	MCAL		11.7	122				Expansion = 9.4% under 1ksf when wetted.
5				50/3"	SPT		8.8					
10				50/1"	SPT		7.0					
15				50/1"	SPT							
20				50/1"	SPT		7.0					
25				50/1"	SPT		7.2					
30												

NOTES:
Boring terminated at approximately 24-feet below ground surface.
Boring was backfilled with auger cuttings on February 08, 2012.
Groundwater was not encountered during drilling.

KLEINFELDER
Bright People. Right Solutions.

Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

BORING LOG

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

BORING
B-2

Boring Location:	See Boring Location Plan	Drill Company:	Custom Auger Drilling	Auger Diameter:	4 inches
Date Started:	February 8, 2012	Drill Equipment:	CME-45	Sampling Method:	SPT & MCAL
Date Completed:	February 8, 2012	Drilling Method:	Solid Stem Auger	Hammer Type:	140 lb. Automatic
Logged By:	L. Frank			Hammer Drop:	30 inches

Depth (feet)	Graphical Log	DESCRIPTION	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Sample Type	LABORATORY: ASTM Symbol	LABORATORY: Moisture Content (%)	LABORATORY: Dry Density (pcf)	LABORATORY: Liquid Limit (NV=No Value)	LABORATORY: Plasticity Index (NP=No Plasticity)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests/ Remarks
		Surface Condition: Bare Earth and Straw										
		Colluvium Lean CLAY (CL), brown, dry to moist, firm, with claystone fragments										
		Pierre Shale Formational Bedrock CLAYSTONE TO SHALE BEDROCK, brown to dark gray, dry to slightly moist, very hard, gypsum present in partings and joints		50/4"	MCAL		12.1	126				Expansion = 11.8% under 1ksf when wetted.
5				50/5"	SPT		10.5					
10				50/1"	SPT		7.1					
15				50/2"	SPT		7.5					
20				50/2"	SPT		6.9					
25				50/0"	SPT							
30												

NOTES:
Boring terminated at approximately 24-feet below ground surface.
Boring was backfilled with auger cuttings on February 08, 2012.
Groundwater was not encountered during drilling.

KLEINFELDER
Bright People. Right Solutions.

Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

BORING LOG

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

BORING
B-3

Boring Location:	See Boring Location Plan	Drill Company:	Custom Auger Drilling	Auger Diameter:	4 inches
Date Started:	February 8, 2012	Drill Equipment:	CME-45	Sampling Method:	SPT & MCAL
Date Completed:	February 8, 2012	Drilling Method:	Solid Stem Auger	Hammer Type:	140 lb. Automatic
Logged By:	L. Frank			Hammer Drop:	30 inches

Depth (feet)	Graphical Log	DESCRIPTION	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Sample Type	LABORATORY: ASTM Symbol	LABORATORY: Moisture Content (%)	LABORATORY: Dry Density (pcf)	LABORATORY: Liquid Limit (NV=No Value)	LABORATORY: Plasticity Index (NP=No Plasticity)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests/ Remarks
		Surface Condition: Grass & Weeds										
		Colluvium Lean CLAY (CL), brown, slightly moist to moist, firm, claystone fragments present										
		Pierre Shale Formational Bedrock CLAYSTONE TO SHALE BEDROCK, brown to dark gray, dry to slightly moist, gypsum in partings and joints		50/3"	MCAL		10.5	127				Expansion = 5.6% under 1ksf when wetted.
5				50/3"	SPT		9.3					
10				50/1"	SPT		7.2					
15				50/1"	SPT		7.5					
20				50/1"	SPT							
25				50/1"	SPT							
30												

NOTES:
Boring terminated at approximately 24-feet below ground surface.
Boring was backfilled with auger cuttings on February 08, 2012.
Groundwater was not encountered during drilling.

KLEINFELDER
Bright People. Right Solutions.

Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

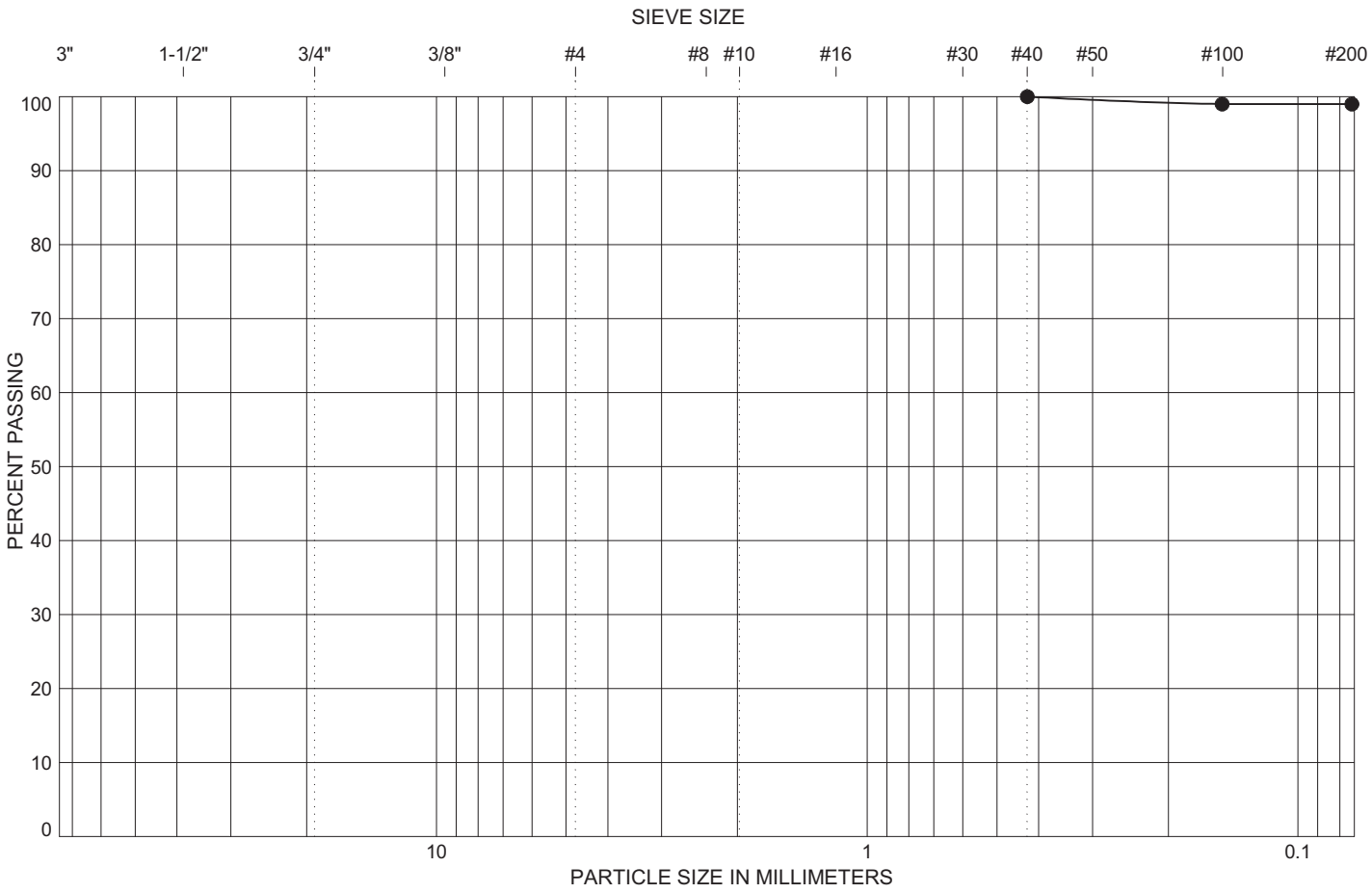
BORING LOG

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

BORING
B-4

APPENDIX C

Geotechnical Laboratory Test Results



Percent Passing

Symbol	Boring/ Sample	Depth	3/4-inch	#4	#200	LL (%)	PI (%)	Soil Classification
●	B-1	2.0	100	100	99	39	20	LEAN CLAY (CL)

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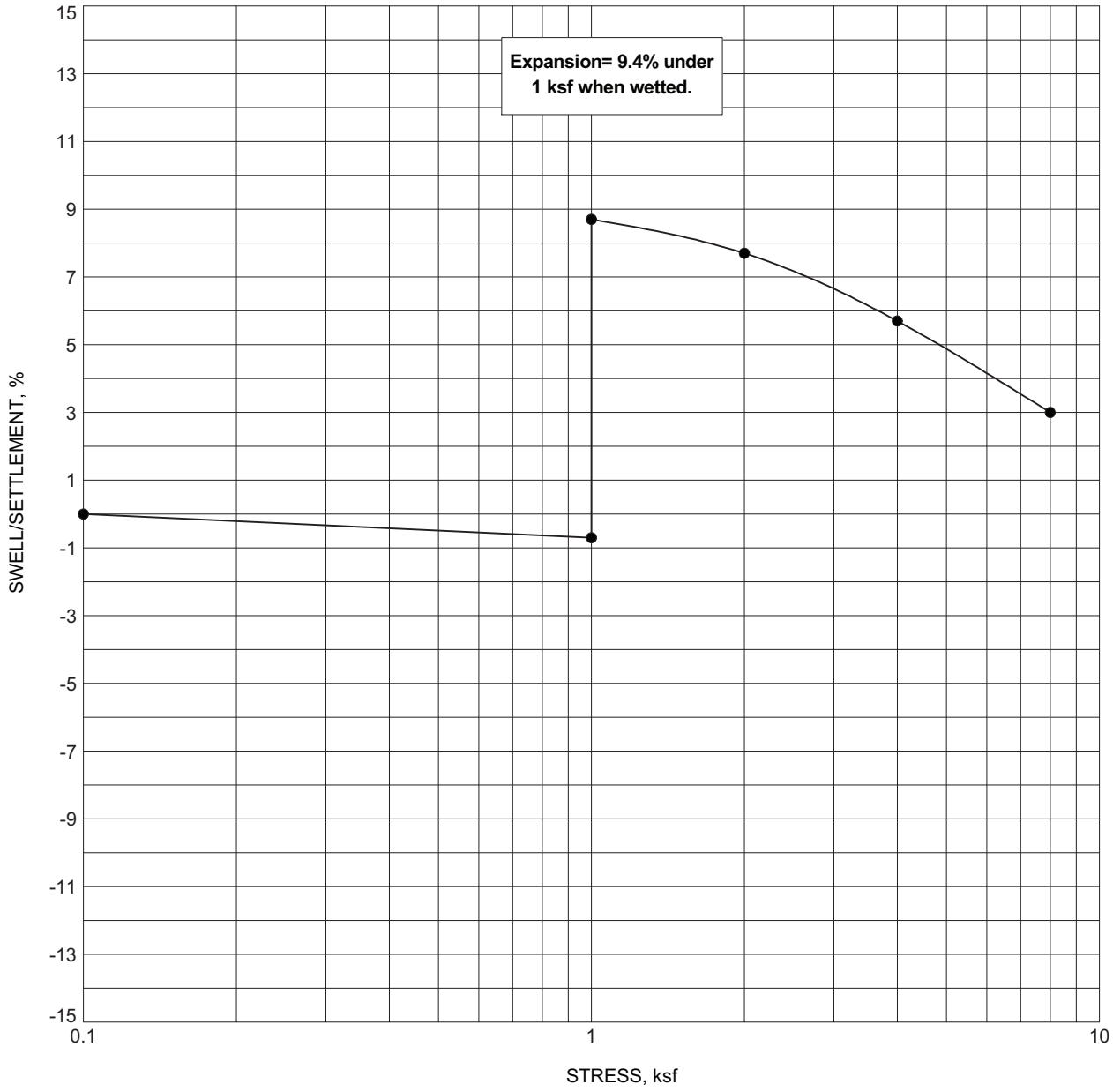
Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

Sieve Analysis & Atterberg Limits

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

PLATE

C-1



Boring: B-2

Depth, ft: 2.0

Soil Classification: CLAYSTONE TO SHALE BEDROCK

Comment:

Total Unit Weight, pcf: 136

Moisture Content, %: 11.7

Dry Unit Weight, pcf: 122

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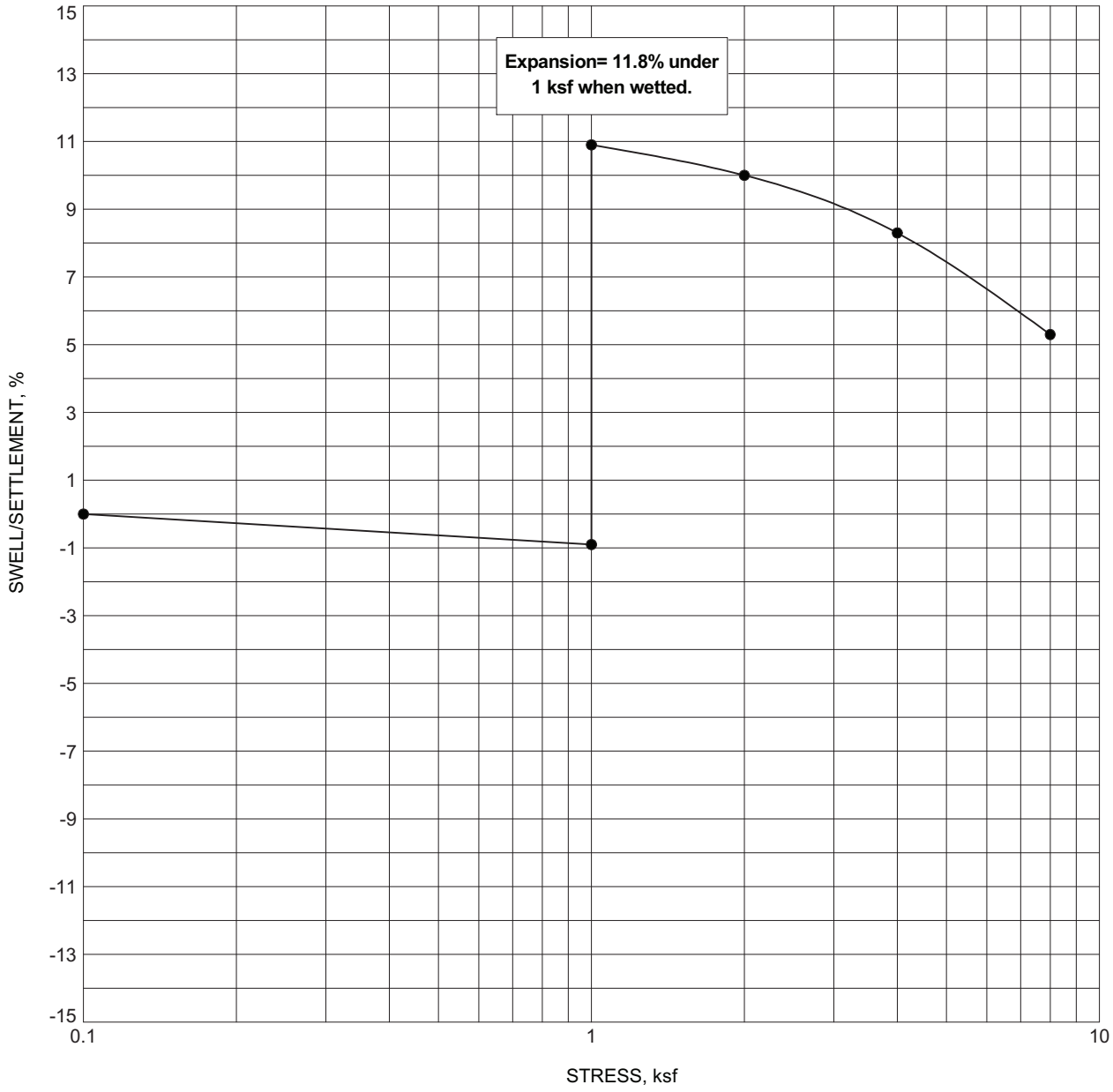
Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

Swell / Settlement

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

PLATE

C-2



Boring: B-3

Depth, ft: 2.0

Soil Classification: CLAYSTONE TO SHALE BEDROCK

Comment:

Total Unit Weight, pcf: 141

Moisture Content, %: 12.1

Dry Unit Weight, pcf: 126

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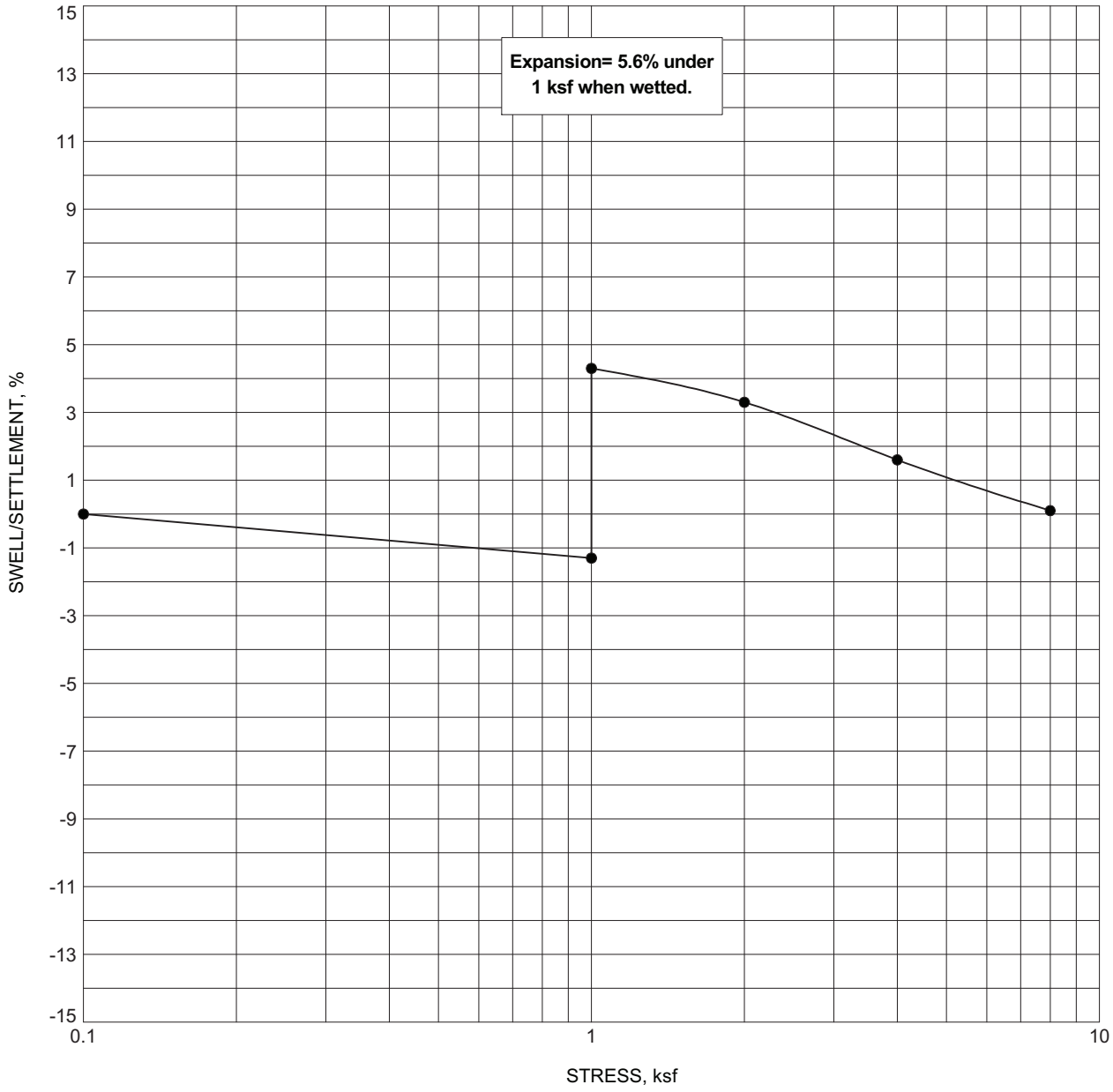
Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

Swell / Settlement

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

PLATE

C-3



Boring: B-4

Depth, ft: 2.0

Soil Classification: CLAYSTONE TO SHALE BEDROCK

Comment:

Total Unit Weight, pcf: 141

Moisture Content, %: 10.5

Dry Unit Weight, pcf: 127

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Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar. 2012
File Name:	125311_geo_gint.gpj

Swell / Settlement

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

PLATE

C-4

BORING NO.	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	GRADATION			ATTERBERG LIMITS		OTHER TESTS	SOIL CLASSIFICATION
				PASSING 3/4-INCH SIEVE(%)	PASSING #4 SIEVE (%)	PASSING -200 SIEVE (%) (% Silt) (% Clay)	LIQUID LIMIT	PLASTICITY INDEX		
B-1	2.0	9.4		100	100	99	39	20		LEAN CLAY (CL)
B-1	4.0	9.0								
B-1	9.0	6.5								
B-1	14.0	6.2								
B-1	19.0	6.9								
B-1	24.0	7.6								
B-2	2.0	11.7	122						Expansion = 9.4% under 1 ksf when wetted.	
B-2	4.0	8.8								
B-2	9.0	7.0								
B-2	19.0	7.0								
B-2	24.0	7.2								
B-3	2.0	12.1	126						Expansion = 11.8% under 1 ksf when wetted.	
B-3	4.0	10.5								
B-3	9.0	7.1								
B-3	14.0	7.5								
B-3	19.0	6.9								
B-4	2.0	10.5	127						Expansion = 5.6% under 1 ksf when wetted.	
B-4	4.0	9.3								
B-4	9.0	7.2								
B-4	14.0	7.5								

KLEINFELDER
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Project Number:	125311
Drawn By:	D. DiCenso
Reviewed By:	B. Mustain
Review Date:	Mar., 2012
File Name:	125311_geo_gint.gpj

Laboratory Test Result Summary

RTR Site Relocation
Pueblo Memorial Airport
Pueblo, Colorado

TABLE

C-1

APPENDIX D

Important Information About Your Geotechnical Engineering Report

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

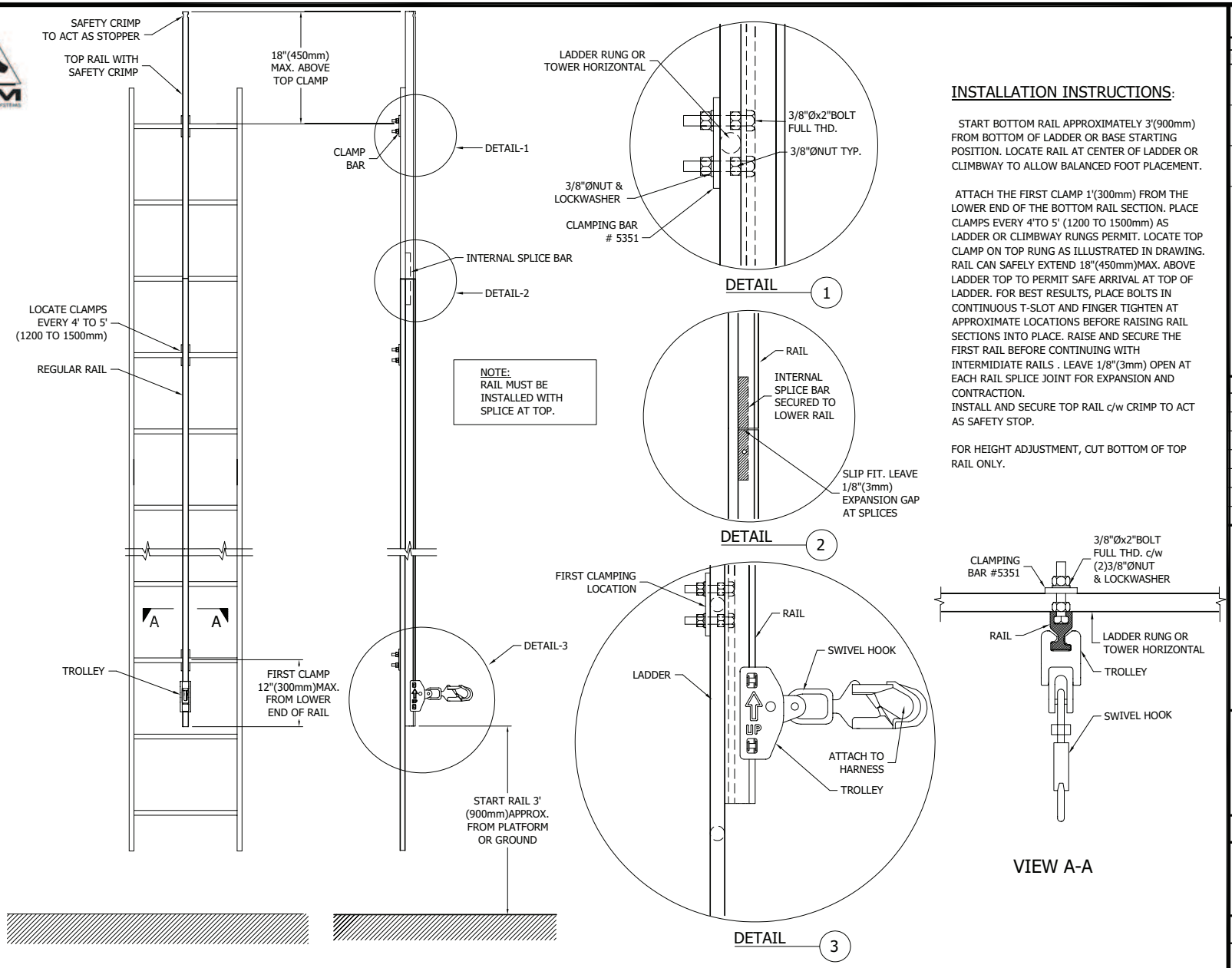
ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER06045.0M

TOWERS FABRICATION & ERECTION DOCUMENTS

(TO BE PROVIDED SEPARATELY WHEN AVAILABLE)



INSTALLATION INSTRUCTIONS:

START BOTTOM RAIL APPROXIMATELY 3'(900mm) FROM BOTTOM OF LADDER OR BASE STARTING POSITION. LOCATE RAIL AT CENTER OF LADDER OR CLIMBWAY TO ALLOW BALANCED FOOT PLACEMENT.

ATTACH THE FIRST CLAMP 1'(300mm) FROM THE LOWER END OF THE BOTTOM RAIL SECTION. PLACE CLAMPS EVERY 4'TO 5' (1200 TO 1500mm) AS LADDER OR CLIMBWAY RUNGS PERMIT. LOCATE TOP CLAMP ON TOP RUNG AS ILLUSTRATED IN DRAWING. RAIL CAN SAFELY EXTEND 18"(450mm)MAX. ABOVE LADDER TOP TO PERMIT SAFE ARRIVAL AT TOP OF LADDER. FOR BEST RESULTS, PLACE BOLTS IN CONTINUOUS T-SLOT AND FINGER TIGHTEN AT APPROXIMATE LOCATIONS BEFORE RAISING RAIL SECTIONS INTO PLACE. RAISE AND SECURE THE FIRST RAIL BEFORE CONTINUING WITH INTERMIDIATE RAILS . LEAVE 1/8"(3mm) OPEN AT EACH RAIL SPLICE JOINT FOR EXPANSION AND CONTRACTION.
INSTALL AND SECURE TOP RAIL c/w CRIMP TO ACT AS SAFETY STOP.

FOR HEIGHT ADJUSTMENT, CUT BOTTOM OF TOP RAIL ONLY.

FILE NO.
STANDARD-CL

REVISIONS

REV.	DESCRIPTION	DWN	CHK	APP
1	PAL NUT CHANGED TO ANCO NUT. DATE: Jan/01/2001	HHR	JMC	D.A
2	TITLE BLOCK CHANGED TO RADIAN FROM LeBLANC. DATE: Jan/18/2002	JMC	D.A	DJA
3	REMOVED BOLT ASS'Y AT TOP RAIL, AND REPLACED WITH CRIMP TO ACT AS SAFETY STOP. REVISED NOTE. DATE: May/05/2003	JTB	J.K	

DWG REFERENCE

RADIAN
OAKVILLE, ON, CANADA
TELEPHONE +1 905 844 1242
FACSIMILE +1 905 844 8837
St CHARLES, MO, USA
TELEPHONE +1 636 922 3250
FACSIMILE +1 636 922 3238
www.radiancorp.com

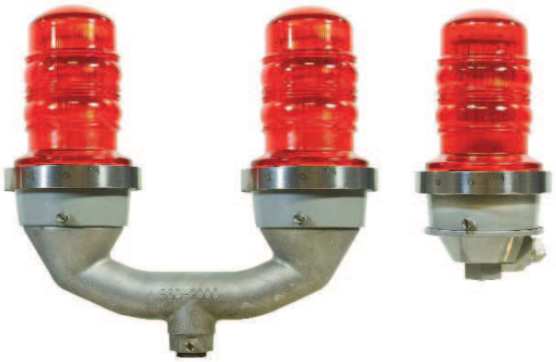
SAFETY CLIMB
RAM RAIL

DWN:	CHK'D:	DATE:
HHR	D.A	Jun/05/2003

ENG'R:	ENG'R APP'D:
RKA	

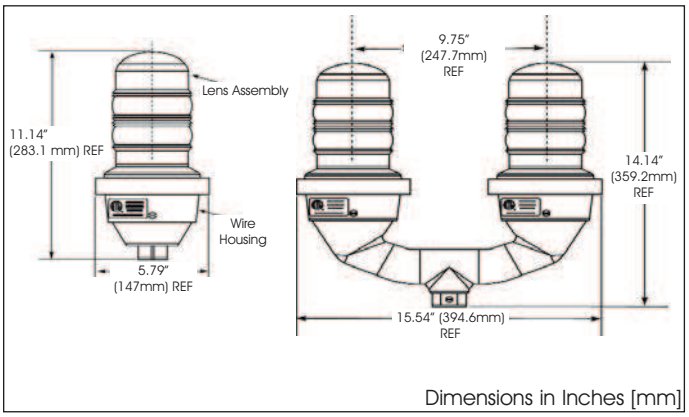
DRAWING NO:	REV:
CL001-E01	3

Jun/05/2003 9:30:32 AM
\Erection\



US Patent #6,425,678 other patents pending

Vigilant™ Series LED Based 860 L-810 Red LED Obstruction Lights



Dimensions in Inches [mm]

Certifications & Ratings

- FAA AC NO: 150/5345-43F
- FAA Engineering Brief No. 67
- IP65 rated
- IP66 rated
- NEMA 4X Rated

Qualified By

- Intertek ETL
- Lighting Sciences Canada

Compliant to

- DGAC Mexico
- ICAO Annex 14, 5th Edition, July 2009
- ICAO Aerodromes Design Manual, Chapter 18
- Canadian Aviation Regulation CAR 621.19 (Transport Canada)
- Nachrichten für Luftfahrer Teil I Langen, 6. Januar 2005
- German Air Traffic Control Notices For Pilots Part I 6, January 2005
- CASA

Features & Benefits

- Full performance 5 year warranty
- Shock and vibration resistant
- Patented optic with sharp beam cutoff
- Available as a single or dual unit
- Available in 12VDC, 24VDC, 48VDC, 120VAC, and 230VAC versions (50 or 60HZ)
- Unique optically designed lens to enhance LED operation and provide 360° visibility
- Weather/corrosion resistant lamp assembly andhousing
- Self-contained wiring compartment eliminates additional boxes
- Threaded 1" and 3/4" bottom hub for mounting
- Can be operated steady or flashed (controller not supplied)
- Complete Performance 5 year warranty
- Rugged metal design

Application:

The Dialight Vigilant™ 860 series is an FAA type L-810 red LED obstruction light. Designed for steady burning, this fixture is used to mark any obstacle that may present hazards to aircraft navigation.

Unit Weight:	7.14 lb (3.23 kg) (Single Unit) 16.06 lb (7.28 kg) (Dual Unit)
Supply voltage ranges:	Nominal +/- 10%
Wattage:	15W / 120mA (120 VAC Units) 16W / 120mA (230 VAC Units - 60 Hz) 16W / - (230 VAC Units - 50 Hz) 24W / 2.0A (12 VDC Units - Standard) 20W / 920mA (24 VDC Units) 13W / 275mA (48 VDC Units)
Operating Temp:	-67°F to +131°F (-55°C to +55°C)

Order codes:

Part Number	Configuration	Compliance	Operating Voltage
860-1R01-001	Single Fixture	FAA	120 VAC
860-1R03-001	Single Fixture	FAA	12 VDC
860-1R04-001	Single Fixture	FAA	48 VDC
860-1R05-001	Single Fixture	FAA	24 VDC
860-1R02-001	Single Fixture	FAA	230 VAC
860-5R02-001	Single Fixture	ICAO, 10cd	230 VAC
860-6R01-001	Single Fixture	TC	120 VAC
860-7R02-001	Single Fixture	CASA, 100cd	230 VAC
860-1R02-001-EU	Single Fixture	ICAO	230 VAC
860-4R02-001-EU	Single Fixture	ICAO, 50cd	230 VAC
860-1R01-002	Dual Fixture	FAA	120 VAC
860-1R03-002	Dual Fixture	FAA	12 VDC
860-1R04-002	Dual Fixture	FAA	48 VDC
860-1R05-002	Dual Fixture	FAA	24 VDC
860-1R02-002	Dual Fixture	FAA	230 VAC
860-5R02-002	Dual Fixture	ICAO, 10 cd	230 VAC
860-6R01-002	Dual Fixture	TC	120 VAC
860-7R02-002	Dual Fixture	CASA,100 cd	230 VAC
860-1R02-002-EU	Dual Fixture	ICAO	230 VAC
860-4R02-002-EU	Dual Fixture	ICAO, 50cd	230 VAC

Dialight also offers these LED obstruction lights for use in Hazardous Locations (Class I, Div. 2)

SafeSite® Series L-810 Red LED Obstruction Lights

SafeSite® Series 860 LED Steady Burn Visual Signals

SafeSite® Series FLS Series Flashing Visual Signals

U.S. Department of Transportation
Federal Aviation Administration

RTR COMMUNICATIONS SITE RELOCATION
AT
PUEBLO MEMORIAL AIRPORT

31201 Bryan Circle
PUEBLO, COLORADO 81001

INDEX OF DRAWINGS

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS — WESTERN SERVICE AREA

RTR
RTR SITE RELOCATION
COVER SHEET

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY | SUBMITTED BY | APPROVED BY

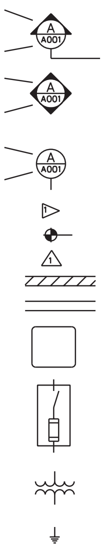
DESIGNED | DRAWN | CHECKED | ISSUED BY: ENGINEERING SERVICES TERMINAL | DATE | JCN | DRAWING NO: PUB-D-RTR-G001 | REV

ISSUED FOR: CONSTRUCTION

ABBREVIATIONS LIST

A.B.	ANCHOR BOLT	FA	FRESH AIR	I.D.	INSIDE DIAMETER	SA	SUPPLY AIR
ACC.	ACOUSTIC	FAA	FEDERAL AVIATION ADMINISTRATION	INSUL.	INSULATING / INSULATION	S.C.	SOLID CORE
ACM	ASBESTOS CONTAINING MATERIAL	F.D.	FLOOR DRAIN	INTER.	INTERMEDIATE	SCH.	SCHEDULE
A.F.	AIR FORCE	F.E.	FIRE EXTINGUISHER	INV.	PIPE INVERT	S.D.	SMOKE DETECTOR
A.F.F.	ABOVE FINISH FLOOR	F.E.C.	FIRE EXTINGUISHER CABINET			SHT.	SHEET
AHU	AIR HANDLER UNIT	FES	FLARED END SECTION	L	ANGLE, LIGHT	SIM.	SIMILAR
ALUMIN.	ALUMINUM	FIN.	FINISH	L.S.D.	LATHER SOAP DISPENSER	STL	STEEL
ARSR	AIR ROUTE SURVEILLANCE RADAR	FL.	FLOOR			SQ. FT.	SQUARE FEET
ARTCC	AIR ROUTE TRAFFIC CONTROL CENTER	FND.	FOUNDATION	MATCT	MOBILE AIRPORT TRAFFIC CONTROL TOWER	SR.	SITE REPRESENTATIVE
AST	ABOVE GROUND STORAGE TANK	F.S.	FIRE SPRINKLER	MAX.	MAXIMUM	S.R.	SUPPLY REGISTER
ATCT	AIRPORT TRAFFIC CONTROL TOWER	F.S.K.	FOIL/SCRIM/KRAFT	MECH.	MECHANICAL	S.S.	STAINLESS STEEL
		FTG.	FOOTING	MEZZ.	MEZZANINE	STARS	STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM
BC	BARE COPPER	FT.	FEET / FOOT	MIN.	MINIMUM		
B.D.	BALANCING DAMPER			MISC.	MISCELLANEOUS	SUSP.	SUSPENDED
B.O.	BOTTOM OF	GA.	GAUGE	M.O.	MASONRY OPENING		
B.P.	BASE PLATE	GALV.	GALVANIZED	MR.	MIRROR	TEL.	TELEPHONE
		GAL.	GALLON	MTL	METAL	TG	TOP OF GRATE
CAB	CABINET	G.B.	GRAB BAR	M.D.	MOTORIZED DAMPER	T.O.	TOP OF
C.I.	CAST IRON	G.C.	GENERAL CONTRACTOR	M.U.T.C.D.	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES	T.O.E.	THREADED ONE END
C.I.H.	CERTIFIED INDUSTRIAL HYGIENIST	GFE	GOVERNMENT FURNISHED EQUIPMENT			T.O.D.	TOP OF DECK
C.J.	CONTROL JOINT	GL.	GLASS	N.E.C.	NATIONAL ELECTRICAL CODE	T.O.F.	TOP OF FOOTING
CL	CENTER LINE	GRS.	GALVANIZED RIGID STEEL	N.E.M.A.	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION	T.O.P.	TOP OF BASE PLATE
CFM.	CUBIC FEET PER MINUTE	GYP.	GYPSUM	N	NORTH	T.O.S.	TOP OF STEEL
CFR.	CODE OF FEDERAL REGULATIONS	GYP.BD.	GYPSUM BOARD	N.I.C.	NOT IN CONTRACT	TRACON	TERMINAL RADAR APPROACH CONTROL
CLG	CEILING			N.T.S.	NOT TO SCALE	T.S.I.	THERMAL SYSTEM INSULATION
C.O.	CLEAN OUT	HW	HARDWARE	NO.	NUMBER	T.T.D.	TOILET TISSUE DISPENSER
COMB.	COMBINATION	H.B.	HOSE BIB			TV	TELEVISION
CONC.	CONCRETE	H.	HOLLOW	O.C.	ON CENTER	TYP.	TYPICAL
CONT'D.	CONTINUED	H.C.	HANDICAPPED	O.D.	OUTSIDE DIAMETER		
CORR.	CORRIDOR	HD. WD.	HARDWOOD	OPP.	OPPOSITE	U.N.O.	UNLESS NOTED OTHERWISE
COR	CONTRACTING OFFICER'S REPRESENTATIVE	HVAC.	HEATING, VENTILATING, AND AIR CONDITIONING				
COTR	CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE	HT., HGT	HEIGHT	PL	PLATE	VAT	VINYL ASBESTOS TILE
				PLWD.	PLYWOOD	VAV	VARIABLE AIR VOLUME
C.T.	CERAMIC TILE			PP	POWER POLE	VCT	VINYL COMPOSITION TILE
CT.J.	CONSTRUCTION JOINT			PSI.	POUNDS PER SQUARE INCH	V.I.F.	VERIFY IN FIELD
℄	CENTER LINE			P.T.D.	PAPER TOWEL DISPENSER	VTR	VENT THROUGH ROOF
				PVC	POLYVINYL CHLORIDE		
D C	DIAPER CHANGING					W.W.F.	WELDED WIRE FABRIC
D.F.	DRINKING FOUNTAIN			RA	RETURN AIR	W.W.M.	WELDED WIRE MESH
D.I.	DUCTILE IRON			R, RAD.	RADIUS	W.	WIDTH
DIA.	DIAMETER			RCP	REINFORCED CONCRETE PIPE	W/	WITH
DIM.	DIMENSION			R.D.	ROOF DRAIN	W/O	WITHOUT
DN	DOWN			R.E.	RESIDENT ENGINEER	WD.	WOOD
D.S.	DOWN SPOUT			REFRIG.	REFRIGERATOR		
D.W.	DISHWASHER			REINF.	REINFORCING		
DWGS.	DRAWINGS			REQ'D.	REQUIRED		
				REV.	REVISION		
EA.	EACH			RM.	ROOM		
E.F.	EXHAUST FAN			R.O.	ROUGH OPENING		
E.J.	EXPANSION JOINT			R.S.	ROUGH SAWN		
EL.	ELEVATION						
E.P.	ESSENTIAL PANEL						
EQ.	EQUAL						
EWC	ELECTRIC WATER CHILLER						
EXIST.	EXISTING						
E.I.F.S.	EXTERIOR INSULATION AND FINISH SYSTEM						

SYMBOLS LEGEND



BUILDING SECTION INDICATION — SECTION NUMBER OR LETTER; SHEET ON WHICH SECTION IS DRAWN

ELEVATION INDICATION — ELEVATION NUMBER; SHEET ON WHICH ELEVATION IS DRAWN

DETAIL INDICATION — DETAIL NUMBER OR LETTER; SHEET ON WHICH DETAIL IS DRAWN

CONSTRUCTION NOTE

ELEVATION DESIGNATION

REVISION

NEW WALL

EXISTING WALL

EQUIPMENT AS NOTED

FUSED DISCONNECT SWITCH

TRANSFORMER

GROUND CONNECTION

MATERIALS LEGEND

NOTE: NOT ALL MATERIALS SHOWN ARE INCORPORATED INTO PROJECT.

PLYWOOD	ALUMINUM
GYPSUM BOARD	STEEL
BLANKET INSULATION	STEEL WALL FRAMING
MINERAL/CERAMIC WOOL	RIGID INSULATION
CONCRETE OR CEMENT	EARTH
	GRAVEL OR GRANULAR FILL

GENERAL NOTES

1. INTENT OF DOCUMENTS:
THE INTENTION OF THE CONTRACT DOCUMENTS IS TO INCLUDE ALL LABOR AND MATERIALS, EQUIPMENT AND TRANSPORTATION NECESSARY FOR THE PROPER AND COMPLETE EXECUTION OF THE WORK, AND EQUAL IN QUALITY AND WORKMANSHIP TO THE HIGHEST STANDARDS. THE CONTRACTOR IS TO ABIDE BY AND COMPLY WITH THE TRUE INTENT AND MEANING OF ALL DRAWINGS AND SPECIFICATIONS TAKEN AS A WHOLE; AND IS NOT BE BENEFIT HIMSELF, TO THE DETRIMENT OF THE WORK, OF ANY OBVIOUS UNINTENTIONAL ERROR OR OMISSION SHOULD THEY EXIST. ALL MINOR DETAILS OF WORK WHICH ARE NOT SHOWN ON THE PLANS, AS WELL AS SUCH ITEMS AS ARE NOT SPECIFICALLY MENTIONED IN THE SPECIFICATIONS BUT ARE OBVIOUSLY NECESSARY FOR THE PROPER COMPLETION OF THE WORK SHALL BE CONSIDERED AS INCIDENTAL AND AS BEING PART OF THE WORK.

2. DIMENSIONS:
WHERE NO DIMENSIONS ARE GIVEN, THE DRAWINGS SHALL BE ACCURATELY FOLLOWED ACCORDING TO THEIR SCALE. DIMENSIONS SUPERSEDE SCALE.

3. EXISTING CONDITIONS:
THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO STARTING WORK. NOTIFY THE CONTRACTING OFFICER'S REPRESENTATIVE (RE/COTR) SHOULD ANY DISCREPANCY OCCUR BETWEEN ACTUAL CONDITIONS AND PLANS. DO NOT START WORK UNTIL DISCREPANCIES ARE RESOLVED.

4. INSPECTION:
INSPECTION OF THE WORK WILL BE UNDER THE DIRECTION OF THE CONTRACTING OFFICER OR THE RE/COTR.

5. CLEAN UP:
THE CONTRACTOR SHALL AT ALL TIMES, KEEP THE PREMISES FREE FROM ACCUMULATION OF WASTE MATERIAL OR RUBBISH CAUSED BY HIS EMPLOYEES OR HIS WORK. SUCH WASTE MATERIAL AND RUBBISH SHALL NOT BE DISPOSED OF ON SITE, BUT BE HAULED AWAY AND DISPOSED OF LEGALLY. BURNING OF ANY WASTE MATERIAL OR RUBBISH ON THE SITE IS PROHIBITED. PROVIDE ENCLOSED DUMPSTERS FOR STORAGE OF WASTE.

6. UTILITIES:
THE CONTRACTOR WILL BE RESPONSIBLE FOR REPAIRING ALL UTILITIES WHICH MAY BE DISTURBED OR DAMAGED BY CONSTRUCTION AND BE LIABLE FOR THE COST OF ANY REPAIRS TO SUCH UTILITIES ARISING FROM THE EXECUTION OF HIS WORK. THE CONTRACTOR IS RESPONSIBLE FOR CONTINUOUS PROTECTION OF EXISTING UTILITIES. IN THE EVENT OF ACCIDENTAL DISRUPTION OF UTILITIES, THE CONTRACTOR SHALL NOTIFY THE RE/COTR IMMEDIATELY.

7. SCHEDULING:
THE CONTRACTOR WILL BE REQUIRED TO SCHEDULE ANY AND ALL DELIVERIES OF MATERIALS DURING THE OFF PEAK USAGE OF THE AREA. SCHEDULE UTILITY INTERRUPTIONS AT LEAST 72 HOURS IN ADVANCE AND DURING OFF PEAK TIMES.

8. PARKING:
THE CONTRACTOR IS TO BE AWARE OF PARKING LIMITATIONS AND THE ON-GOING USE OF THE SITE BY THE OWNER. THE SITE MUST REMAIN OPEN AND FREE OF EQUIPMENT.

9. RESTROOM ACCESS: THE CONTRACTOR SHALL PROVIDE TEMPORARY CHEMICAL TOILETS FOR USE BY CONSTRUCTION PERSONNEL.

10. STORAGE:
THE CONTRACTOR IS RESPONSIBLE FOR STORAGE OF HIS MATERIALS. NO STORAGE FACILITIES ARE AVAILABLE WITHIN THE BUILDING. THE CONTRACTOR MAY PROVIDE A TEMPORARY TRAILER AND/OR FENCING AT HIS OPTION.

11. PATCHING:
PATCH ALL AREAS DISTURBED BY CONSTRUCTION. PATCH SHALL MATCH THE ORIGINAL MATERIAL IN EVERY RESPECT INCLUDING MATERIAL TYPE AND SHALL BE FLUSH WITH ADJACENT SURFACES AND MATCH IN COLOR, TEXTURE AND SHEEN.

12. COLOR SELECTION:
ALL COLORS SHALL MATCH THE EXISTING BUILDING COLORS AS SELECTED AND APPROVED BY THE RE/COTR

13. CODES AND STANDARDS:
ALL CONSTRUCTION SHALL MEET OR EXCEED THE MINIMUM REQUIREMENTS OF THE
- INTERNATIONAL BUILDING CODE (IBC) 2009 EDITION
- NATIONAL ELECTRICAL CODE (NEC), CURRENT EDITION
- NFPA 70, CURRENT EDITION
- INTERNATIONAL FIRE CODE (IFC) 2009 EDITION
- INTERNATIONAL MECHANICAL CODE (IMC) 2009 EDITION
- FAA STANDARDS 1217I ELECTRICAL WORK, INTERIOR
- FAA STANDARD 019E LIGHTNING PROTECTION, GROUNDING, BONDING AND SHIELDING REQUIREMENTS FOR FACILITIES

ALL WORK, INCLUDING END WORKING CONDITIONS SHALL COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH STANDARDS AS ESTABLISHED BY THE U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).

14. POWER AND WATER:
LIMITED USE OF POWER AND WATER MAY BE AVAILABLE AT THE SITE. THE CONTRACTOR SHALL CONSERVE ALL UTILITIES AS MUCH AS PRACTICAL.

15. MATERIAL QUALITY:
UNLESS OTHERWISE SPECIFIED, ALL MATERIALS SHALL BE NEW, AND BOTH WORKMANSHIP AND MATERIALS SHALL BE OF HIGH QUALITY. THE CONTRACTOR SHALL IF REQUIRED, FURNISH SATISFACTORY EVIDENCE AS TO THE KIND AND QUALITY OF MATERIALS. ALL MATERIAL SHALL BE A SUITABLE GRADE FOR THE INTENDED USE.

16. WORKMANSHIP:
ALL WORK SHALL BE PERFORMED IN A CRAFTSMAN LIKE MANNER BY PERSONS TRAINED AND SKILLED IN THE APPROPRIATE TRADE.

17. SITE ACCESS AND BADGING REQUIREMENTS :
THE FAA RTR SITE IS IN A SECURE AREA THE CONTRACTOR SHALL MINIMIZE INGRESS AND EGRESS. AN ADVANCE LIST OF CONSTRUCTION PERSONNEL SHALL BE PROVIDED AND APPROVED BY THE RE/COTR.
THE CONTRACTOR SHALL COMPLY WITH ALL FAA AND AIRPORT REQUIREMENTS FOR ACCESS. THE CONTRACTOR IS RESPONSIBLE FOR ALL PERSONNEL ON THE CONSTRUCTION PROJECT AND ARRAINGINGING ESCORTS FOR DELIVERIES.

18. LOCATE SERVICES:
DO NOT EXCAVATE BEFORE UNDERGROUND LOCATE IS COMPLETED. EXCAVATE BY HAND WITH SHOVELS WITHIN 5 FEET OF A BURIED CABLE CROSSINGS AND EXISTING STRUCTURES.

19. LAYDOWN SITE:
THE CONTRACTOR LAYDOWN AREAS WILL BE VERIFIED AT THE PRE-CONSTRUCTION MEETING. THE CONTRACTOR SHALL MAINTAIN 5'-0" MINIMUM SET BACK FROM SECURITY FENCE ON ALL MATERIAL, EQUIPMENT, AND TRAILERS.

20. PRE-CONSTRUCTION MEETING:
THE CONTRACTOR SHALL IDENTIFY THE FOLLOWING ITEMS;
A. CONCRETE TRUCK CLEAN OUT
B. VEHICLE PARKING
C. MATERIAL STAGING AREAS
D. USE OF CRANE OR OTHER EQUIPMENT

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

RTR SITE RELOCATION
ABBREVIATIONS, GENERAL NOTES, SYMBOLS LEGEND AND MATERIALS LEGEND

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

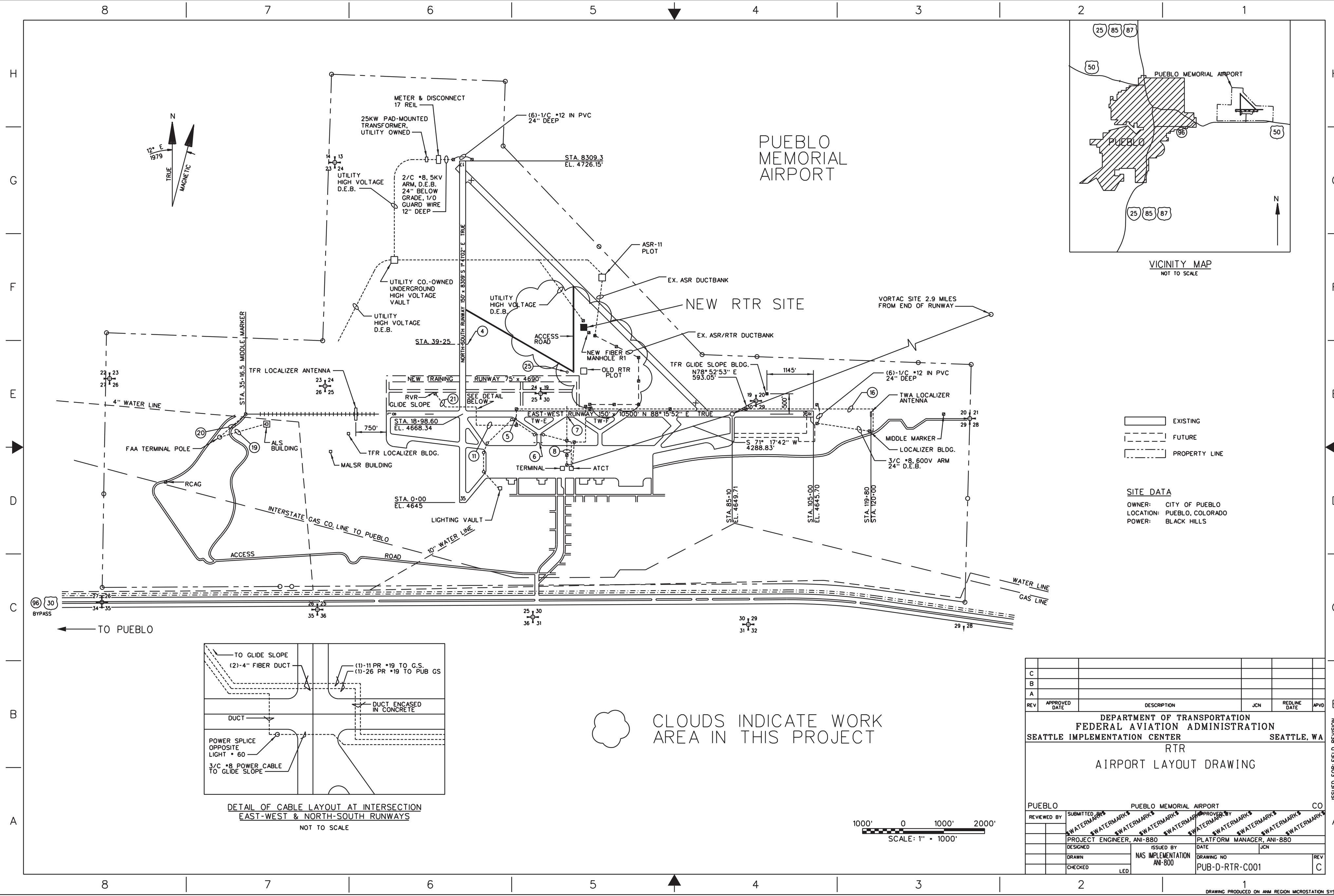
REVIEWED BY | SUBMITTED BY | APPROVED BY

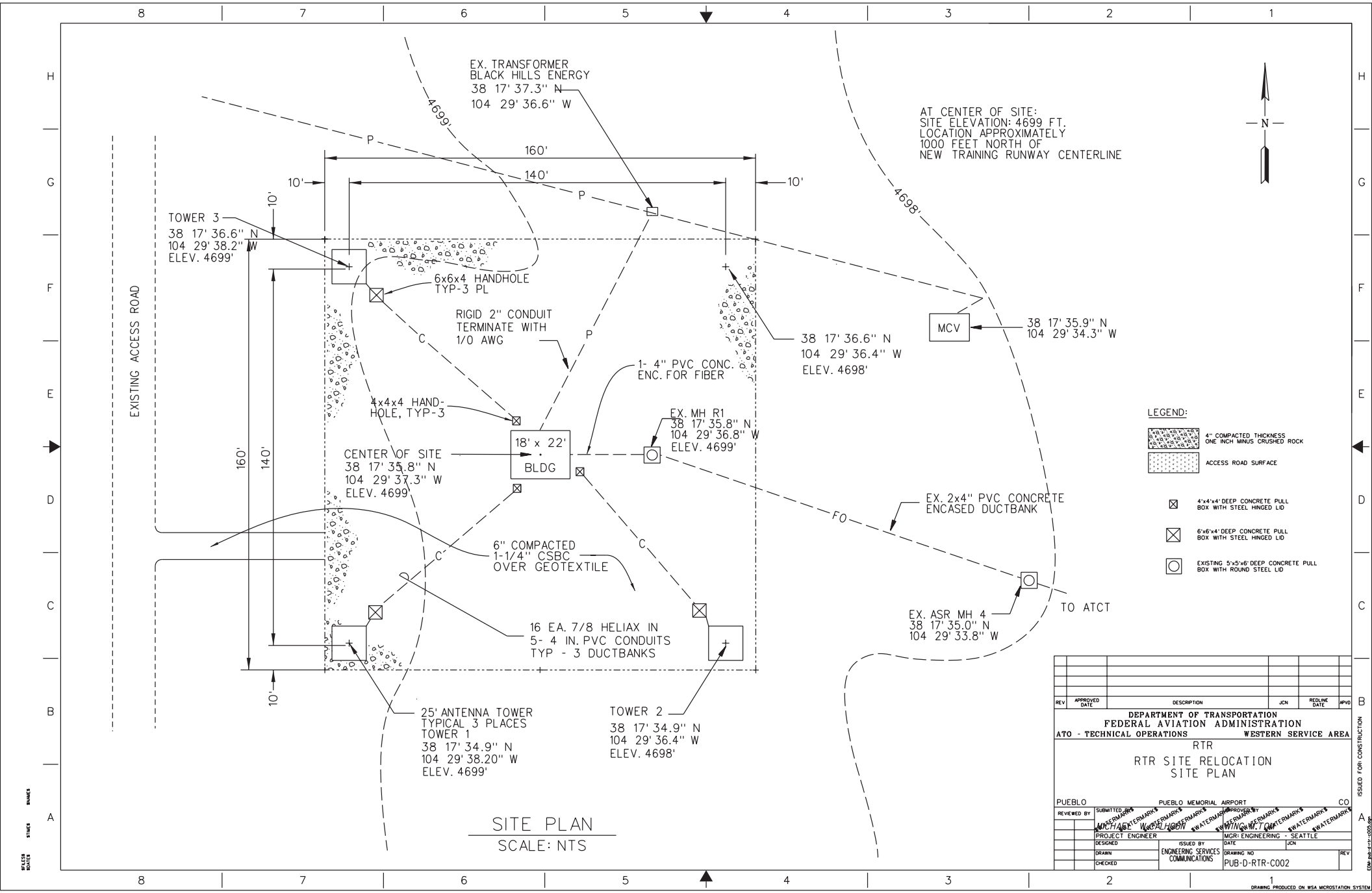
$WATERMARK$

DESIGNED | DRAWN | CHECKED | ISSUED BY | DATE | JCN | DRAWING NO PUB-D-RTR-G002 | REV

ISSUED FOR:

EDM: pub-d-rtr-g002.dgn


PUEBLO MEMORIAL AIRPORT
NEW RTR SITE
CLOUDS INDICATE WORK AREA IN THIS PROJECT
VICINITY MAP
NOT TO SCALE
PUEBLO MEMORIAL AIRPORT
PUEBLO
EXISTING
FUTURE
PROPERTY LINE
SITE DATA
OWNER: CITY OF PUEBLO
LOCATION: PUEBLO, COLORADO
POWER: BLACK HILLS
METER & DISCONNECT 17 REIL
25KW PAD-MOUNTED TRANSFORMER, UTILITY OWNED
(6)-1/C #12 IN PVC 24" DEEP
STA. 8309.3 EL. 4726.15'
2/C #8, 5KV ARM, D.E.B. 24" BELOW GRADE, 1/0 GUARD WIRE 12" DEEP
UTILITY HIGH VOLTAGE D.E.B.
UTILITY CO.-OWNED UNDERGROUND HIGH VOLTAGE VAULT
ASR-11 PLOT
EX. ASR DUCTBANK
EX. ASR/RTR DUCTBANK
VORTAC SITE 2.9 MILES FROM END OF RUNWAY
ACCESS ROAD
NEW FIBER MANHOLE R1
OLD RTR PLOT
STA. 39+25
NORTH-SOUTH RUNWAY 150' x 8309' S 1°41'02" E TRUE
TFR LOCALIZER ANTENNA
STA. 35+16.5 MIDDLE MARKER
NEW TRAINING RUNWAY 75' x 4690'
RVR GLIDE SLOPE
SEE DETAIL BELOW
STA. 18+98.60 EL. 4668.34
750'
EAST-WEST RUNWAY 150' x 10500' N 88°15'52" E TRUE
TW-E
TW-F
TFR GLIDE SLOPE BLDG. N78°52'53" E 593.05'
1145'
500'
S 71° 17'42" W 4288.83'
TWA LOCALIZER ANTENNA
MIDDLE MARKER
LOCALIZER BLDG.
3/C #8, 600V ARM 24" D.E.B.
4" WATER LINE
FAA TERMINAL POLE
ALS BUILDING
TFR LOCALIZER BLDG.
MALSR BUILDING
RCAG
TERMINAL
ATCT
STA. 0+00 EL. 4645
LIGHTING VAULT
INTERSTATE GAS CO. LINE TO PUEBLO
10" WATER LINE
ACCESS ROAD
STA. 85+10 EL. 4649.71
STA. 105+00 EL. 4645.70
STA. 119+80 STA. 120+00
WATER LINE
GAS LINE
BYPASS
TO PUEBLO
TO GLIDE SLOPE
(2)-4" FIBER DUCT
(1)-11 PR #19 TO G.S. (1)-26 PR #19 TO PUB GS
DUCT ENCASED IN CONCRETE
DUCT
POWER SPLICE OPPOSITE LIGHT # 60
3/C #8 POWER CABLE TO GLIDE SLOPE
DETAIL OF CABLE LAYOUT AT INTERSECTION EAST-WEST & NORTH-SOUTH RUNWAYS
NOT TO SCALE
1000' 0 1000' 2000'
SCALE: 1" = 1000'
REV APPROVED DATE DESCRIPTION JCN REDLINE DATE APVD
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SEATTLE IMPLEMENTATION CENTER SEATTLE, WA
RTR
AIRPORT LAYOUT DRAWING
PUEBLO PUEBLO MEMORIAL AIRPORT CO
PROJECT ENGINEER, ANI-880
PLATFORM MANAGER, ANI-880
ISSUED BY NAS IMPLEMENTATION ANI-800
DRAWING NO PUB-D-RTR-C001
REV C
ISSUED FOR: FIELD REVISION
DRAWING PRODUCED ON ANM REGION MICROSTATION SYSTEM



SITE PLAN
SCALE: NTS

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR

RTR SITE RELOCATION SITE PLAN

PUEBLO PUEBLO MEMORIAL AIRPORT CO

REVIEWED BY	SUBMITTED	APPROVED BY	
	PROJECT ENGINEER	MGR: ENGINEERING - SEATTLE	
	DESIGNED	ISSUED BY	DATE / JCN
	DRAWN	ENGINEERING SERVICES COMMUNICATIONS	DRAWING NO: PUB-D-RTR-C002 / REV
	CHECKED		

ISSUED FOR CONSTRUCTION

DRAWING PRODUCED ON WSA MICROSTATION SYSTEM

GENERAL ELECTRICAL NOTES

1. ELECTRICAL INSTALLATION SHALL BE IN ACCORDANCE WITH DIVISION 16 OF CONTRACT SPECIFICATIONS. ALL ELECTRICAL WORK SHALL COMPLY WITH THE CURRENT EDITION OF THE NATIONAL ELECTRICAL CODE (NFPA 70), FAA 019E, AND FAA 1217F.
2. ALL EQUIPMENT DIMENSIONS SHOWN ARE NOMINAL. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND COORDINATE WITH EQUIPMENT TO AVOID SPACE CONFLICTS WHERE NECESSARY. IN NO CASE SHALL NEC ARTICLE 110-26 BE VIOLATED.
3. PERMITTED CONDUIT TYPES ARE RGS, EMT AND PVC. ALL EXTERIOR ABOVE GRADE CONDUIT SHALL BE RGS WITH THREADED FITTINGS. INTERIOR CONDUITS MAY BE EMT WITH COMPRESSION FITTINGS. PVC CONDUIT SHALL ONLY BE PERMITTED FOR GROUND CONDUCTORS OR BURIED CONDUIT UNLESS OTHERWISE INDICATED. CONDUITS UNDER ROADS SHALL BE RGS.
4. PROVIDE ADEQUATE FASTENING AND SUPPORT FOR EQUIPMENT UNDER THIS CONTRACT. TOWER, WALL, AND RACK MOUNTED EQUIPMENT SHALL BE SUPPORTED ON 1-5/8" GALVANIZED STRUT. UPDATE PANEL SCHEDULES TO REFLECT CHANGES MADE UNDER THIS CONTRACT.
5. ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT SHALL INCLUDE PHENOLIC LABELS IDENTIFYING EQUIPMENT, VOLTAGE, AND CURRENT RATING.
6. ALL CONDUCTORS SHALL BE COPPER. POWER CONDUCTORS SHALL BE 12AWG MINIMUM. CONDUCTORS SHALL BE SIZED PER THE DRAWINGS OR THE NEC IF NOT SHOWN. POWER CONDUCTORS SHALL BE SOLID FOR 12AWG. CONDUCTORS 8AWG AND LARGER SHALL BE STRANDED. IDENTIFY BRANCH CIRCUITS WITH SHRINK EMBOSSED LABELS.
7. WHERE POWER AND CONTROL WIRING OCCUPY COMMON HAND HOLES, WIRING SHALL BE SEPARATED ON OPPOSITES SIDES OF HAND HOLE WITH APPROVED CABLE RACK SYSTEM.
8. PROVIDE DEWATERING OF ALL TRENCHES AND EXCAVATIONS IF WATER IS PRESENT DURING CONSTRUCTION OR ACCORDANCE WITH FAA REQUIREMENTS. EXISTING HAND HOLES SHALL BE PUMPED DRY AND KEPT DRY WHILE ACCESSING OR INSTALLING CABLES AND/OR CONDUITS.
9. PROVIDE ALL CONDUIT, JUNCTION BOXES, CABLE, TERMINATIONS, ETC. AS REQUIRED TO COMPLETE POWER AND COMMUNICATION SYSTEMS INSTALLED UNDER THIS CONTRACT. VERIFY CONDUIT RISER LOCATIONS BASED ON FIELD VERIFICATION OF EQUIPMENT LOCATIONS. ADJUST AS NECESSARY WITH RE APPROVAL.
10. BURIED CONDUITS SHALL BE A MINIMUM OF 24" BELOW GRADE UNLESS OTHERWISE NOTED. ALL RISERS SHALL BE RGS TO 24" BELOW GRADE (INCLUDING SWEEP) AND 5'-0" BEYOND THE E.E.S. BEFORE TRANSITIONING TO PVC AND/OR RGS. A GRS BUSHING SHALL BE EXOTHERMICALLY WELDED TO A 2 AWG BARE COPPER AND BONDED TO EARTH ELECTRODE SYSTEM AT THE E.E.S. CROSSING POINT.
11. PROVIDE PULL STRINGS IN ALL CONDUITS INSTALLED FOR USE BY OTHERS. EXISTING CONDUITS TO BE RE-USED, SHALL BE SWABBED AND PULL STRINGS INSTALLED. ALL CONDUIT CONDUCTORS SHALL BE INSTALLED WITHOUT SPLICES.

GENERAL GROUNDING NOTES

1. ALL BELOW GRADE GROUNDING CONNECTIONS SHALL BE EXOTHERMICALLY WELDED - NO EXCEPTIONS.
2. GROUND ELECTRODE CONDUCTORS (G.E.C.) SHALL BE EXOTHERMICALLY WELDED TO EARTH ELECTRODE SYSTEM AND SHALL BE 2AWG MINIMUM.
3. GRS CONDUITS SHALL INCLUDE GROUND BUSHINGS AT ALL J-BOXES AND HANDHOLES FOR CONNECTION TO EQUIPMENT GROUNDS.
4. ALL BELOW GRADE GRS CONDUITS CROSSING EARTH ELECTRODE SYSTEMS SHALL BE EXOTHERMICALLY WELDED TO THE EARTH ELECTRODE SYSTEM AT THE CROSSING POINT WITH A BARE 2AWG COPPER CONDUCTOR.
5. ALL BELOW GRADE PVC POWER AND COMMUNICATION DUCTS SHALL INCLUDE #1/0AWG BARE COPPER GUARD WIRE SYSTEM 10" ABOVE DUCT PER SPECIFICATION REQUIREMENTS AND FAA-STD-019E.
6. LIGHTNING PROTECTION DOWN CONDUCTORS SHALL MAINTAIN A HORIZONTAL OR DOWNWARD COURSE. SUPPORT MAIN AND DOWN CONDUCTORS EVERY 3'-0". ALL CONDUCTORS AND FITTINGS SHALL BE CLASS II.
7. LIGHTNING PROTECTION CONDUCTORS SHALL BE ROUTED EXTERNAL TO ALL STRUCTURES AND SUPPORTED AT 3'-0" INTERVALS. GRADE LEVEL DOWN CONDUCTORS SHALL BE ENCLOSED IN PVC SCHEDULE 40 CONDUIT 12" BELOW GRADE TO 6 '-0 " ABOVE GRADE.
8. LIGHTNING PROTECTION CONDUCTORS SHALL BE BARE COPPER. DOWN AND MAIN CONDUCTORS SHALL BE CLASS II (THOMPSON 28R MINIMUM).
9. NO BENDS IN LIGHTNING DOWN OR ROOF CONDUCTORS SHALL FORM AN INCLUDED ANGLE OF LESS THAN 90 DEGREES. MINIMUM BEND RADIUS OF ROOF AND DOWN CONDUCTORS SHALL BE 8" OR LARGER.
10. MAKE ABOVE GRADE BUTT SPLICES IN TOWER CONDUCTORS WITH DIE CAST 2 BOLT STRAIGHT SPLICER, THOMPSON #705 OR SIMILAR.
11. DOWN CONDUCTORS SHALL BE EXOTHERMICALLY WELDED DIRECTLY TO #4/0 BARE STRANDED COPPER CONDUCTOR A MINIMUM OF 18" ABOVE GRADE. THE #4/0 CONDUCTOR SHALL TERMINATE DIRECTLY TO A GROUND ROD.

GENERAL TOWER NOTES

1. GRIND STEEL FREE OF ANY PAINT OR PROTECTIVE COATING BEFORE MAKING ANY GROUNDING CONNECTIONS. UPON COMPLETION OF CONNECTION, RE-GALVANIZE UNPROTECTED AREAS WITH COLD GALVANIZING PAINT.
2. ALL LIGHTNING PROTECTION EQUIPMENT SHALL BE UL LISTED FOR THIS USE.
3. CONDUIT BENDS SHALL HAVE A MINIMUM BEND RADIUS AS REQUIRED REQUIRED BY THE NEC. CONDUCTOR BEND RADIUS SHALL NOT BE LESS THAN 8 TIMES CABLE OUTSIDE DIAMETER.
4. SEAL ALL PVC CONDUITS USED TO PROTECT GROUND WIRES WATER TIGHT.
5. HALO RING:
   CONTRACTOR SHALL INSTALL (GFM) 28R WOVEN DOWN CONDUCTOR HORIZONTALLY AROUND THE BASE OF THE VERTICAL FACE OF THE PLATFORM TOWER. EXOTERMICALLY ATTACH EVERY 3-FEET. FROM THIS TOWER PLATFORM HALO RING, ATTACH A VERTICAL DOWN CONDUCTOR ON DIAGONAL OPPOSITE LEGS OF THE TOWER AND ROUTE TO THE BURIED E.E.S. CLAMP CONDUCTORS EVERY 3-FEET TO LEGS OF TOWER.
6. CONTRACTOR SHALL REVIEW (GFM) ___________ INC'S SUPPLIED MOUNTING MATERIAL PRIOR TO FURNISHING IF REQUIRED, MOUNTING AND CONNECTION HARDWARE FOR THE (GFM) 28R WOVEN DOWN CONDUCTORS. INSTALL HARDWARE IN ACCORDANCE WITH DETAILS OF _________ INC CONSTRUCTION DRAWINGS. USE LONGER STAINLESS STEEL BOLTS IF NOT FURNISHED TO ACCOMODATE TOWER LEG 3/4" TO 1" STEEL THICKNESS.
7. CONTRACTOR SHALL FURNISH AND INSTALL #4/0 BARE COPPER WIRE TO DIAGONAL OPPOSITE LEGS OF THE TOWER BASE. EXOTHERMICALLY ATTACH TO THE TOWER LEGS AND ROUTE TO THE NEAREST BURIED ESS GROUND ROD.
8. PROVIDE #4/0 GREEN JACKETED COPPER CONDUCTOR WITH RED STRIPE FROM EACH TOWER JUNCTION BOX TO TOWER EES.
9. THE AIR TERMINAL SHALL BE SUPPORTED ON THE STRUCTURAL MEMBER AND SHALL HAVE A UL LISTED FITTING ON ITS BASE. THE DOWN CONDUCTOR FROM THE AIR TERMINAL SHALL BE CONNECTED TO THE THE PERIMETER (HALO RING) CONDUCTOR THAT FORMS A LOOP AROUND THE PERIMETER OF THE TOWER PLATFORM. THE DOWN CONDUCTOR FROM THE AIR TERMINAL SHALL RUN ON THE EXTERIOR OF THE FIBERCAST POLE AND FASTENED AT INTERVALS NOT EXCEEDING 3 FEET.

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

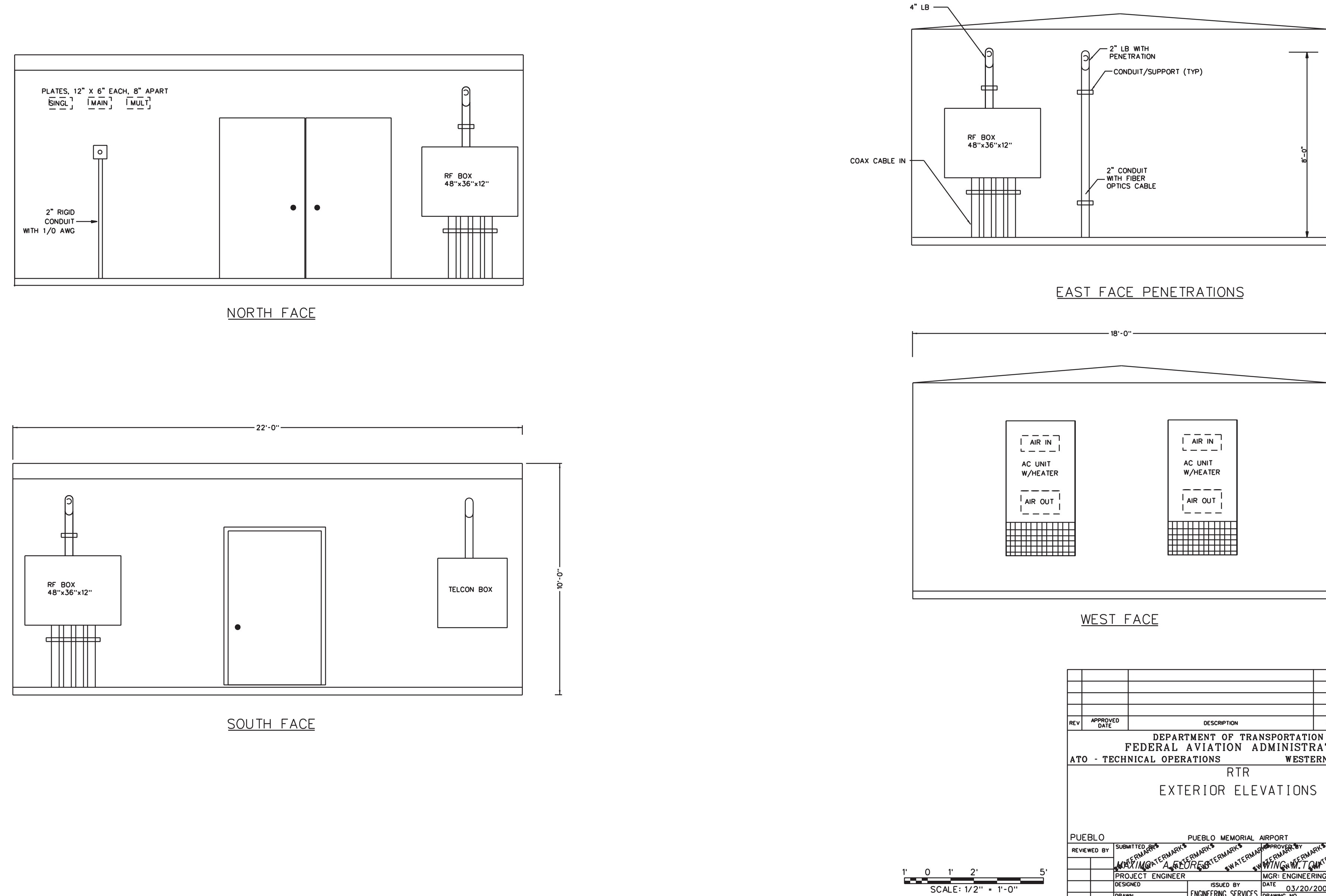
RTR ANTENNA TOWERS
GENERAL ELECTRICAL
GROUNDING AND BONDING NOTES

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY | SUBMITTED BY | APPROVED BY

DESIGNED | DRAWN | CHECKED | ISSUED BY | DATE | JCN | DRAWING NO PUB-D-RTR-C003 | REV

ISSUED FOR:



REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR
EXTERIOR ELEVATIONS

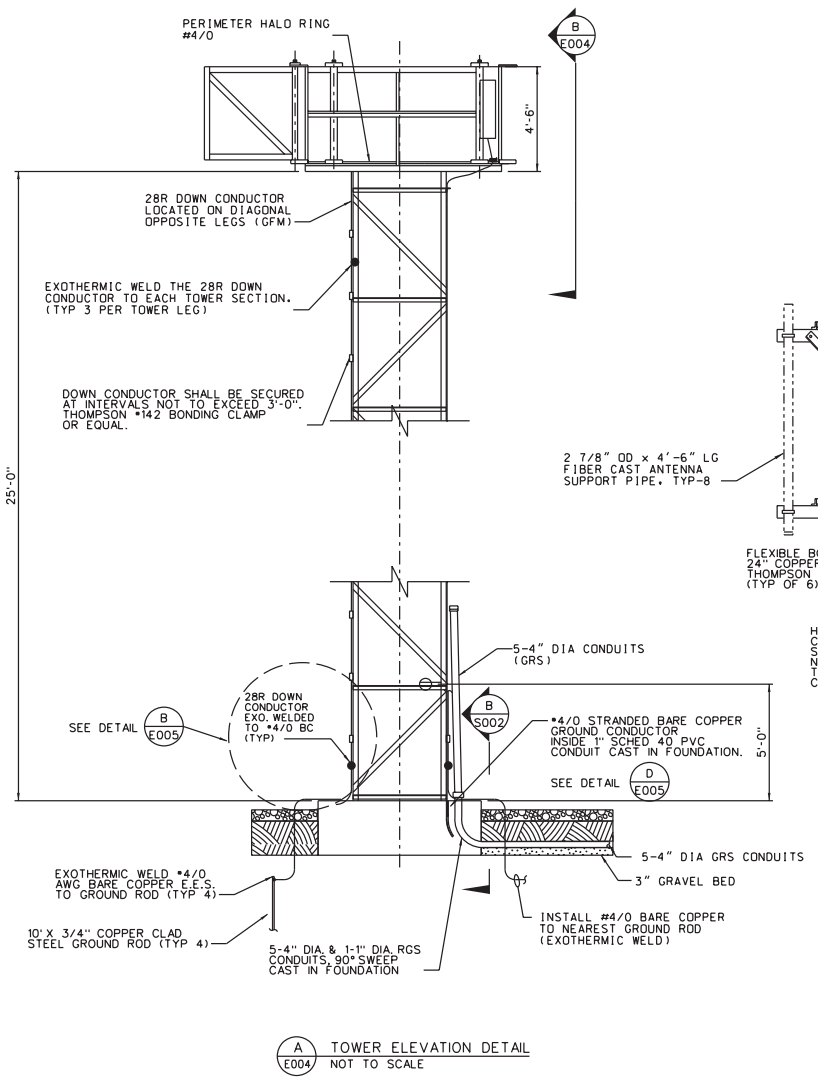
PUEBLO PUEBLO MEMORIAL AIRPORT CO

REVIEWED BY | SUBMITTED BY: MAXIMO A. FLORES, PROJECT ENGINEER | APPROVED BY: WING M. TOM, MGR: ENGINEERING - SEATTLE

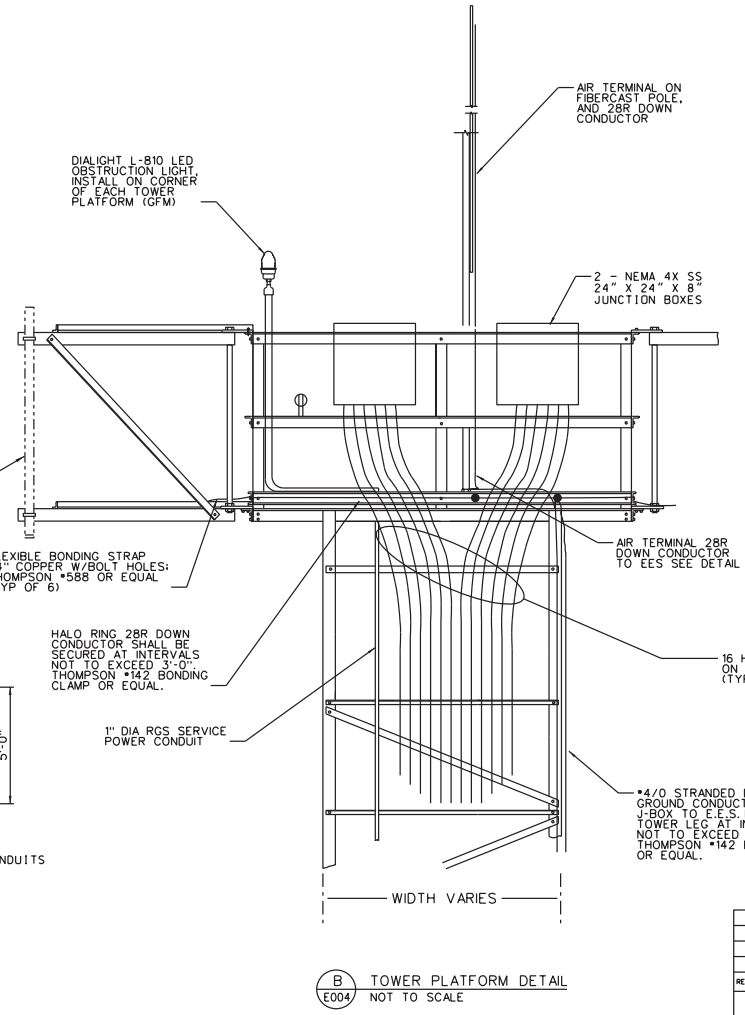
DESIGNED | DRAWN | CHECKED | ISSUED BY: ENGINEERING SERVICES COMMUNICATIONS | DATE 03/20/2008 | JCN 310494 | DRAWING NO PUB-D-RTR-C004 | REV

ISSUED FOR: PROJECT RECORD DRAWING

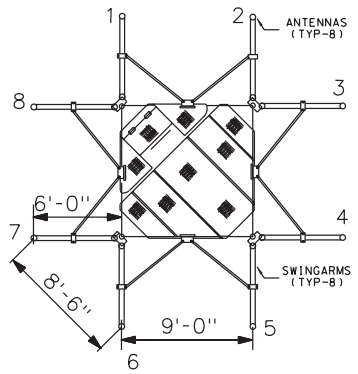
DRAWING PRODUCED ON WSA MICROSTATION SYSTEM



A E004 TOWER ELEVATION DETAIL
NOT TO SCALE



B E004 TOWER PLATFORM DETAIL
NOT TO SCALE



C E005 TOWER PLATFORM PLAN
NOT TO SCALE

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

RTR ANTENNA TOWERS TOWER, PLATFORM, AND

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED	APPROVED BY
	$WATERMARK$	$WATERMARK$

DESIGNED	ISSUED BY	DATE	JCN
DRAWN		DRAWING NO	REV
CHECKED		PUB-D-RTR-C005	

ISSUED FOR:

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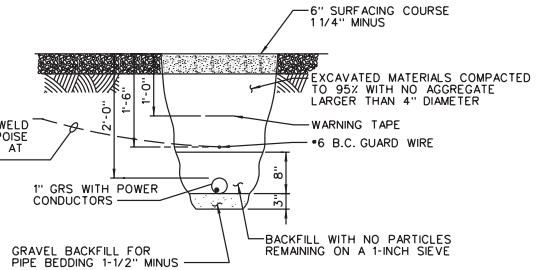
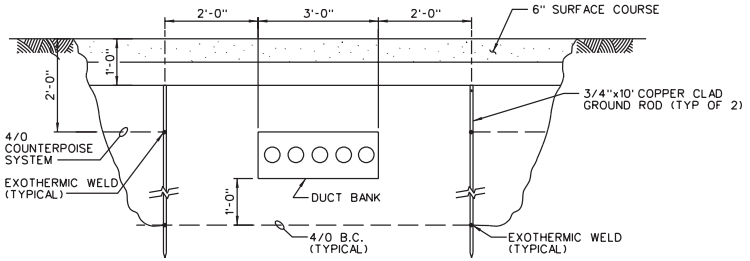
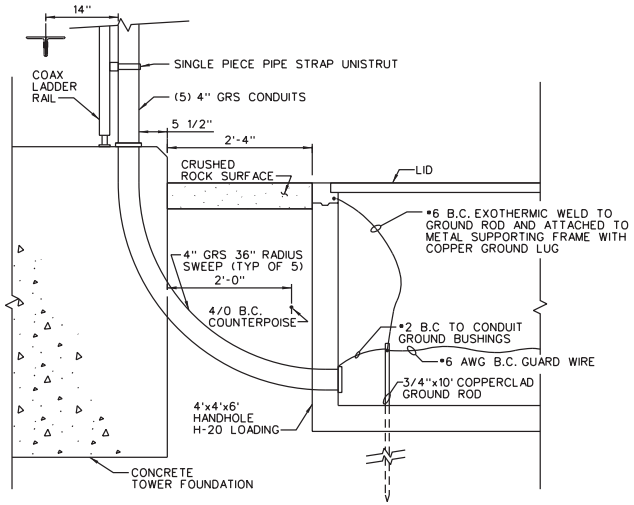
BRUCE A. STINES



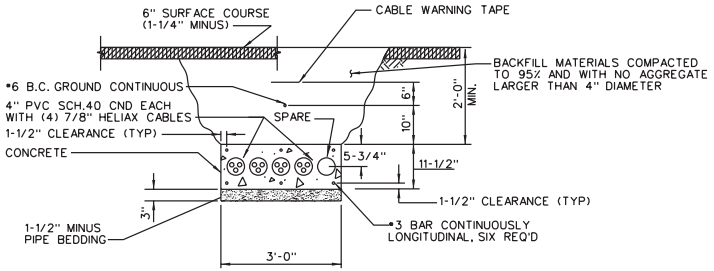
GRS TRENCH DETAIL
SCALE: 1"=1'-0"



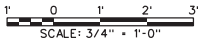
COUNTERPOISE CROSSING DETAIL
SCALE: 3/4"=1'-0"



TOWER FOUNDATION/HANDHOLE DETAILS
SCALE: NTS



(CONCRETE ENCASED)
PVC TRENCH DETAIL
NOT TO SCALE



SCALE: 3/4" = 1'-0"

SCALE: 1" = 1'-0"

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

DUCTBANK DETAILS

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED BY	APPROVED BY

DESIGNED	ISSUED BY	DATE	JCN
DRAWN		DRAWING NO	REV
CHECKED		PUB-D-RTR-C006	

ISSUED FOR:

BRASER STONES BRANCES

EDMS pub-d-rtr-c000.dgn

CONFIGURATION 4 GENERIC BASELINE: E

NOTES:

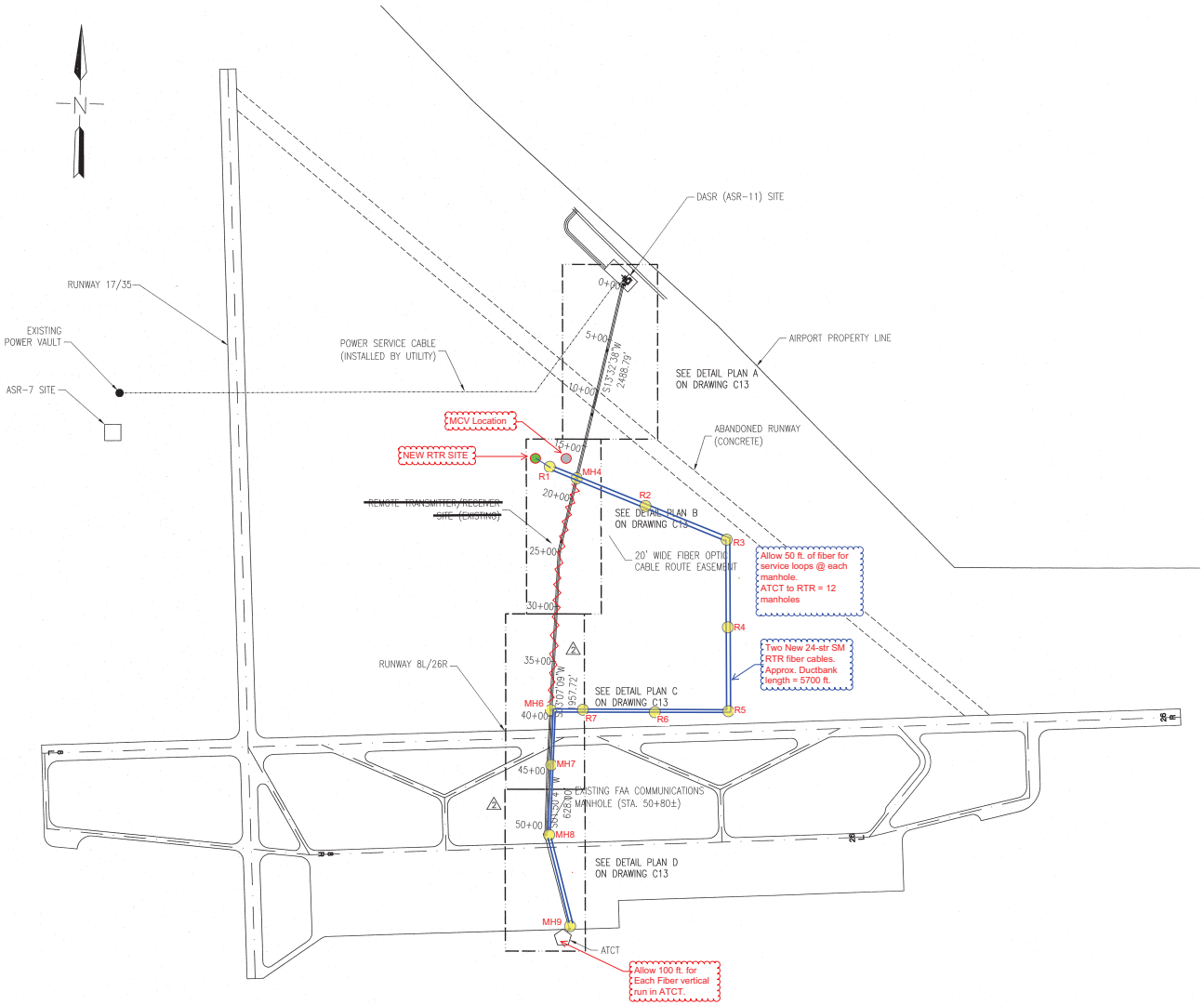
1. SEE DRAWING C6 FOR FIBER OPTIC DUCTBANK DETAILS.

2. PRECAST MANHOLES SHALL BE PLACE AS INDICATED ON DRAWING C13. SEE DRAWING C11 FOR PRECAST MANHOLE DETAILS.

3. ALL HANDHOLES REMOVED EXCEPT AT ASR-11 BELOW RADAR TOWER. SEE DRAWING C11 FOR HANDHOLE DETAILS.

4. FIBER OPTIC CABLE SHALL PROCEED FROM THE DASR SITE TO AN EXISTING FAA MANHOLE NORTH OF RUNWAY 8R/26L, THEN THROUGH THE EXISTING DUCTBANK TO THE EXISTING FAA MANHOLE AT THE TOWER INTO THE CABLE PIT IN THE TOWER, THEN UP THE CABLE SHAFT TO THE THIRD FLOOR EQUIPMENT ROOM. REFER TO DRAWING E31 FOR WIRING DETAILS AT THE EQUIPMENT ROOM.

5. SEE DRAWING C1 FOR LEGEND AND ADDITIONAL NOTES.



FIBER OPTIC CABLE GENERAL ARRANGEMENT

SCALE 1" = 500'

SUPPLEMENTAL LEGEND

REFER TO DWG. DASR-PUB-SYM FOR ADDITIONAL LEGEND.

- HANDHOLE – SEE DRAWING C11 FOR DETAILS
- PRECAST CONCRETE MANHOLE – SEE DRAWING C11 FOR DETAILS
- EXISTING FAA COMMUNICATIONS MANHOLE

500' 250' 0' 500' 1000' 2000'

GRAPHIC SCALE: 1" = 500'

~~AS-BUILT~~

Raytheon
TECHNICAL SERVICES COMPANY LLC
BURLINGTON, MA 01803

REV.LTR.	DATE	DESCRIPTION	CHK'D	APP'D
2	11/10/07	FINAL REVISION	PW	AAS
1	09/20/06	AS-BUILT DRAWING	PW	AAS
0	03/24/06	ISSUED FOR BID	FAV	CEH

ORIGINALLY STAMPED
ORIGINALLY SIGNED BY
PROFESSIONAL
ENGINEER
STATE OF
GEORGIA
FRANK A. VELLA
REG. NO. 15731

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NORTHWEST MOUNTAIN REGION – SEATTLE, WASHINGTON
~~DIGITAL AIRPORT SURVEILLANCE RADAR (DASR)~~

PUEBLO MEMORIAL AIRPORT
PUEBLO, COLORADOPUEBLO, COLORADO
FIBER OPTIC CABLE PLAN
GENERAL ARRANGEMENT

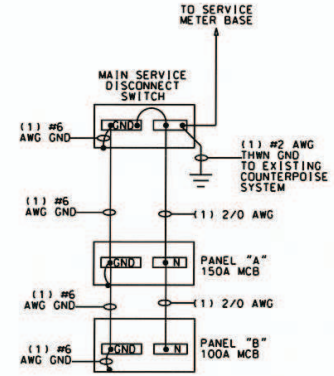
REVIEWED BY	SUBMITTED BY	APPROVED BY

DESIGNED BY FAV
DRAWN BY
CHECKED BY FAV
ISSUED BY
DATE 2/4/2003
DASR-PUB-C12
REV. LTR. 2

GENERAL NOTES:

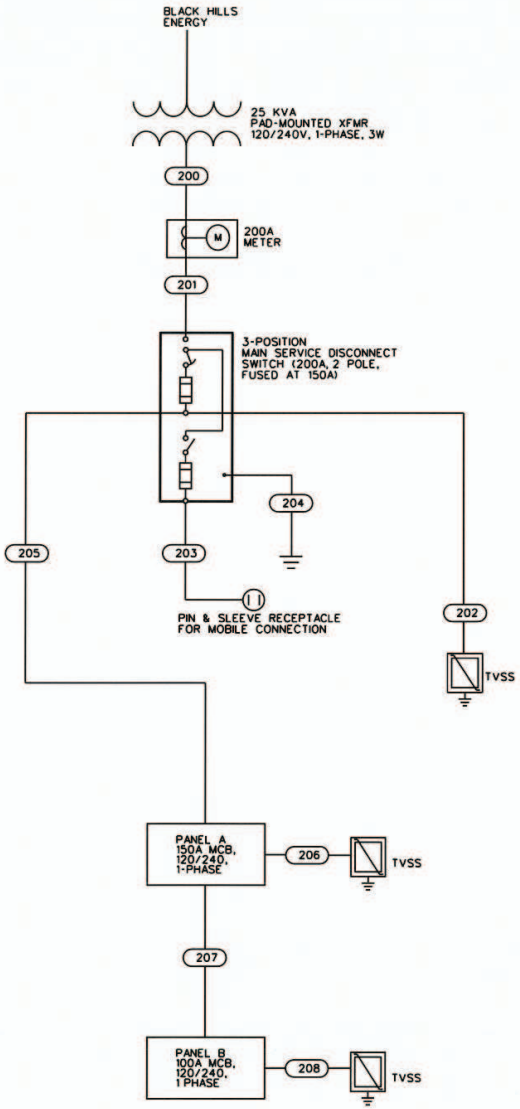
1) ALL ELECTRICAL WORK SHALL COMPLY WITH THE LATEST REVISION OF FAA FAA-C-1217F, "ELECTRICAL WORK, INTERIOR".

2) ALL EQUIPMENT GROUNDING SHALL COMPLY WITH THE LATEST REVISION OF FAA SPECIFICATION FAA-STD-019E, "LIGHTNING PROTECTION, GROUNDING, BONDING AND SHIELDING REQUIREMENTS FOR FACILITIES".



SYSTEM NEUTRAL AND GROUNDING DETAILS

NOT TO SCALE



ONE-LINE DIAGRAM

NOT TO SCALE

REV	APPROVED DATE	DESCRIPTION	JCN	RECDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO-TECHNICAL OPERATIONS — WESTERN SERVICE AREA

RTR

SHELTER & DC BUS ELECTRICAL ONE-LINE DIAGRAM

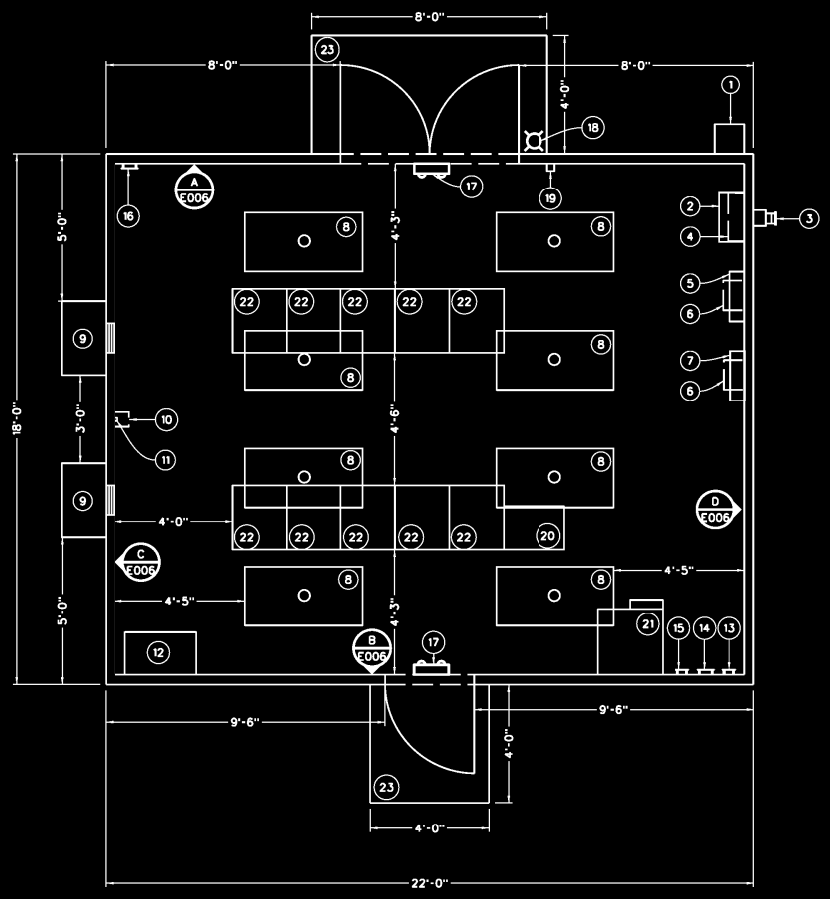
PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED BY: SUBMITTING ENGINEER	APPROVED BY: APPROVING ENGINEER	
	PROJECT ENGINEER	MGR: ENGINEERING - SEATTLE	
	DESIGNED	ISSUED BY: INFRASTRUCTURE ENGINEERING SERVICES	DATE / JCN: 991199
	DRAWN		DRAWING NO: PUB-D-RTR-E001
	CHECKED		REV: X

ISSUED FOR CONSTRUCTION

THIS DRAWING PRODUCED ON THE XXXXXXXXX REGION MICROSTATION SYSTEM

ACTIVE



FLOOR PLAN AND EQUIPMENT LAYOUT

SCALE: 1/2" = 1'-0"

EQUIPMENT LIST

ACTION		QTY.	DESCRIPTION
PROVIDE AND INSTALL BY SHELTER MFR.	1	1	200A KWH METER
PROVIDE AND INSTALL BY SHELTER MFR.	2	1	THREE POSITION MAIN SERVICE DISCONNECT SWITCH
PROVIDE AND INSTALL BY SHELTER MFR.	3	1	200A PORTABLE ENGINE GENERATOR PIN/SLEEVE
INSTALL BY SHELTER MFR. (GFE)	4	1	TVSS (RAYVOSS PN 120-2S-N1-3-06-A) -(GFE)
PROVIDE AND INSTALL BY SHELTER MFR.	5	1	PANEL A (SQUARE-D 150A MCB, 120/240V, 42-CKTS.)
INSTALL BY SHELTER MFR. (GFE)	6	2	TVSS (RAYVOSS PN 120-2S-M3-3-06A) - (GFE)
PROVIDE AND INSTALL BY SHELTER MFR	7	1	PANEL B (SQUARE-D 100A MCB, 120/240V, 42-CKTS.)
PROVIDE AND INSTALL BY SHELTER MFR.	8	8	2' X 4' T-8 LIGHT FIXTURES
PROVIDE AND INSTALL BY SHELTER MFR.	9	2	4 TON MARVAIR HVAC WITH 5KW HEATER (AVPA48ACA050CU)
PROVIDE AND INSTALL BY SHELTER MFR.	10	1	HVAC LEAD/LAG CONTROLLER
PROVIDE AND INSTALL BY SHELTER MFR.	11	1	THERMOSTAT
PROVIDE AND INSTALL BY SHELTER MFR.	12	1	EYE WASH STATION (FEND-ALL 1000 EMERGENCY EYE WASH STATION)
PROVIDE AND INSTALL BY SHELTER MFR.	13	1	MULTIPOINT GROUND PLATE
PROVIDE AND INSTALL BY SHELTER MFR.	14	1	MAIN GROUND PLATE
PROVIDE AND INSTALL BY SHELTER MFR.	15	1	SINGLE POINT GROUND PLATE
PROVIDE AND INSTALL BY SHELTER MFR.	16	1	SUPPLEMENTAL GROUND PLATE
PROVIDE AND INSTALL BY SHELTER MFR.	17	2	EMERGENCY LIGHTS
PROVIDE AND INSTALL BY SHELTER MFR.	18	1	OUTDOOR WALL MOUNTED 100W INCANDESCENT LIGHT
PROVIDE AND INSTALL BY SHELTER MFR.	19	1	DRY CHEMICAL FIRE EXTINGUISHER
PROVIDE AND INSTALL BY FAA (EMERSON)	20	1	DC BUS
PROVIDE AND INSTALL BY FAA (EMERSON)	21	1	DC BUS BATTERIES
PROVIDE AND INSTALL BY FAA	22	10	RADIO RACKS
PROVIDE AND INSTALL BY FAA	23	2	CONCRETE STOOP

FOR OFFICIAL USE ONLY
PUBLIC AVAILABILITY TO BE DETERMINED UNDER 5 USC 552

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR

SHELTER & DC BUS ELECTRICAL NEW SHELTER FLOOR PLAN

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED DO NOT SIGN	APPROVED DO NOT SIGN	
PROJECT ENGINEER		MGR: ENGINEERING - SEATTLE	
DESIGNED KH	ISSUED BY	DATE	JCN 991199
DRAWN KH	ENGINEERING SERVICES INFRASTRUCTURE	DRAWING NO	REV
CHECKED		PUB-D-RTR-E002	X

SCALE: 1/2" = 1'-0"

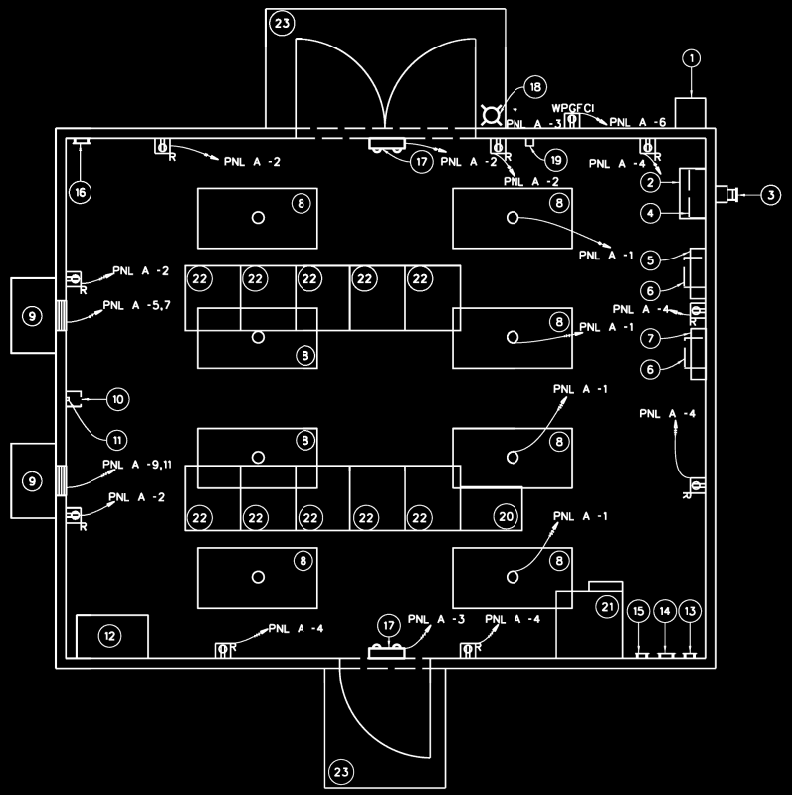
THIS DRAWING PRODUCED ON THE XXXXXXXXXX XGION MICROSTATION SYSTEM

ACTIVE

GENERAL NOTES

1) ALL ELECTRICAL WORK SHALL COMPLY WITH THE LATEST REVISION OF FAA FAA-C-1217F, "ELECTRICAL WORK, INTERIOR".

2) INSTALL ALL RECEPTACLES AT 18" ABOVE FINISHED FLOOR.



POWER PLAN
SCALE: 1/2" = 1'-0"

SCALE: 1/2" = 1'-0"

FOR OFFICIAL USE ONLY
PUBLIC AVAILABILITY TO BE DETERMINED UNDER 5 USC 552

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS — WESTERN SERVICE AREA

RTR

SHELTER & DC BUS
ELECTRICAL
POWER PLAN

PUEBLO — CO

REVIEWED BY:	SUBMITTED BY: DO NOT SIGN	APPROVED BY: DO NOT SIGN	
	PROJECT ENGINEER	MCR: ENGINEERING - SEATTLE	
	DESIGNED: KDN	ISSUED BY: ENGINEERING SERVICES INFRASTRUCTURE	DATE: 991199
	DRAWN: KDN		DRAWING NO: PUB-D-RTR-E003
	CHECKED		REV: X

ISSUED FOR CONSTRUCTION

THIS DRAWING PRODUCED ON THE XXXXXXXXX REGION MICROSTATION SYSTEM

CONDUIT AND CABLE SCHEDULE 1

CONDUIT & CABLE IDENTIFICATION				CONDUIT			CONDUCTOR			
NUMBER	DWG	FROM	TO	SIZE	TYPE	LENGTH	DESCRIPTION	SIZE	FUNCTION	COLOR
(200)	E001	XFMR	METER	2"	RSC		UTILITY XFMR TO METER	2/0 AWG STRD/THWN	NL1 PHASE	BLACK
								2/0 AWG STRD/THWN	NL2 PAHSE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
(201)	E001	UTILITY METER	MAIN SERVICE DISCONNECT SWITCH	2"	RSC		COMMERCIAL DISCONNECT FEEDER TO ATS INPUT	2/0 AWG STRD/THWN	NL1 PHASE	BLACK
								2/0 AWG STRD/THWN	NL2 PHASE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(202)	E001	MAIN SERVICE DISCONNECT SWITCH	TVSS	2"	EMT		MAIN SERVICE DISCONNECT SWITCH TO TVSS	2/0 AWG STRD/THWN	EL1 PHASE	BLACK
								2/0 AWG STRD/THWN	EL2 PHASE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(203)	E001	PIN & SLEEVE RECEPTACLE FOR MOBILE CONNECTION	MAIN SERVICE DISCONNECT SWITCH	2"	EMT		FACILITY ATS OUTPUT TO FACILITY LOAD DISCONNECT	2/0 AWG STRD/THWN	L1 PHASE	BLACK
								2/0 AWG STRD/THWN	L2 PHASE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(204)	E001	MAIN SERVICE DISCONNECT SWITCH	FACILITY COUNTERPOISE	1"	PVC		NEC CODE REQUIRED FACILITY NEUTRAL TO GROUND BOND	#2 AWG BARE COPPER	GROUND	BARE
(205)	E001	MAIN SERVICE DISCONNECT SWITCH	PANEL A	2"	EMT		MAIN SERVICE DISCONNECT TO PANEL A	2/0 AWG STRD/THWN	L1 PHASE	BLACK
								2/0 AWG STRD/THWN	L2 PHASE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(206)	E001	PANEL A	TVSS	1 1/4"	EMT		PANEL A TO TVSS	#2 AWG STRD/THWN	L1 PHASE	BLACK
								#2 AWG STRD/THWN	L2 PHASE	RED
								#2 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(207)	E001	PANEL A	PANEL B	2"	EMT		PANEL A FEEDING PANEL B WITH 125A BREAKER	2/0 AWG STRD/THWN	L1 PHASE	BLACK
								2/0 AWG STRD/THWN	L2 PHASE	RED
								2/0 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN
(208)	E001	PANEL B	TVSS	1 1/4"	EMT		PANEL B TO TVSS	#2 AWG STRD/THWN	L1 PHASE	BLACK
								#2 AWG STRD/THWN	L2 PHASE	RED
								#2 AWG STRD/THWN	NEUTRAL	WHITE
								#6 AWG STRD/THWN	GROUND	GREEN

CONDUIT AND CABLE SCHEDULE
NOT TO SCALE

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD
D					
C					
B					
A					

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO-TECHNICAL OPERATIONS — WESTERN SERVICE AREA

RTR
SHELTER & DC BUS
ELECTRICAL
CONDUIT AND CABLE SCHEDULE

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED BY	APPROVED BY	
	SUBMITTING ENGINEER	APPROVING ENGINEER	
	PROJECT ENGINEER	MGR: ENGINEERING - SEATTLE	
	DESIGNED	ISSUED BY	DATE / JCN
	DRAWN	ENGINEERING SERVICES INFRASTRUCTURE	991199
	CHECKED		DRAWING NO / REV
			PUB-D-RTR-E004

ISSUED FOR CONSTRUCTION

THIS DRAWING PRODUCED ON THE XXXXXXXXXX REGION MICROSTATION SYSTEM

ACTIVE

EQUIPMENT PANEL BOARD "A" SCHEDULE

MANUFACTURER SQUARE-D — MODEL NUMBER NQOD
CIRCUIT BREAKER TYPE — SERIES
PHASE SINGLE — NUMBER OF WIRES 3 — VOLTS 120/240 — AMPS 225
MAIN BREAKER AMPS 150 — SURFACE MOUNT ENCLOSURE

SERVICE	AMPS	A	B	AMPS	SERVICE
LIGHTS	20	1	2	125	PANEL B
OUTSIDE DOOR LIGHT	20	3	4		
HVAC #1	40	5	6	20	OUTSIDE GFCI RECEPTACLE
		7	8	20	EMERGENCY LIGHTS & OUTSIDE
HVAC #2	40	9	10	20	EAST WALL RECEPTACLES
		11	12	20	WEST WALL RECEPTACLES
SPARE	20	13	14	60	TVSS
SPARE	20	15	16		
SPARE	20	17	18	20	SPARE
SPARE	20	19	20	20	SPARE
SPARE	20	21	22	20	SPARE
SPACE		23	24		SPACE
SPACE		25	26		SPACE
SPACE		27	28		SPACE
SPACE		29	30		SPACE
SPACE		31	32		SPACE
SPACE		33	34		SPACE
SPACE		35	36		SPACE
SPACE		37	38		SPACE
SPACE		39	40		SPACE
SPACE		41	42		SPACE

150

NEW EQUIPMENT PANEL BOARD "A" SCHEDULE

NOT TO SCALE

ELECTRONICS PANEL BOARD "B" SCHEDULE

MANUFACTURER SQUARE-D — MODEL NUMBER NQOD
CIRCUIT BREAKER TYPE — SERIES
PHASE SINGLE — NUMBER OF WIRES 3 — VOLTS 120/240 — AMPS 224
MAIN BREAKER AMPS 100 — SURFACE MOUNT ENCLOSURE

SERVICE	AMPS	A	B	AMPS	SERVICE
SPARE	20	1	2	20	SPARE
SPARE	20	3	4	20	SPARE
SPARE	20	5	6	20	SPARE
SPARE	20	7	8	20	SPARE
SPARE	20	9	10	20	SPARE
SPARE	20	11	12	20	SPARE
SPARE	20	13	14	20	SPARE
SPARE	20	15	16	20	SPARE
SPARE	30	17	18	60	TVSS
		19	20		
SPARE	30	21	22		SPACE
		23	24		SPACE
SPACE		25	26		SPACE
SPACE		27	28		SPACE
SPACE		29	30		SPACE
SPACE		31	32		SPACE
SPACE		33	34		SPACE
SPACE		35	36		SPACE
SPACE		37	38		SPACE
SPACE		39	40		SPACE
SPACE		41	42		SPACE

100

NEW ELECTRONICS PANEL BOARD "B" SCHEDULE

NOT TO SCALE

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REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO-TECHNICAL OPERATIONS — WESTERN SERVICE AREA

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SHELTER & DC BUS ELECTRICAL NEW PANEL SCHEDULE

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

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	PROJECT ENGINEER	MGR. ENGINEERING - SEATTLE
	DESIGNED KH	DATE 991199
	DRAWN KH	ISSUED BY: ENGINEERING SERVICES INFRASTRUCTURE
	CHECKED	DRAWING NO. PUB-D-RTR-E005 — REV X

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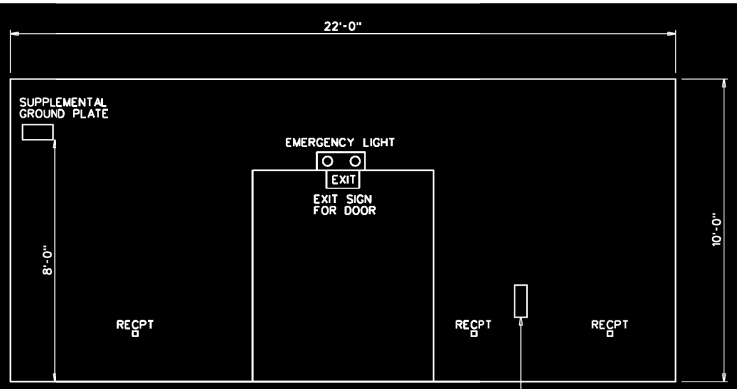
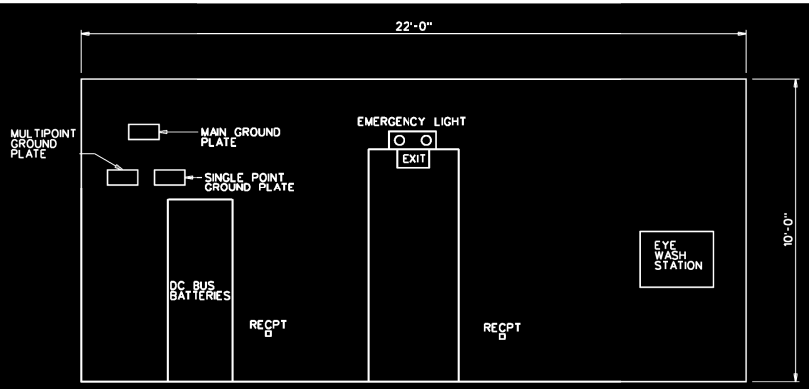
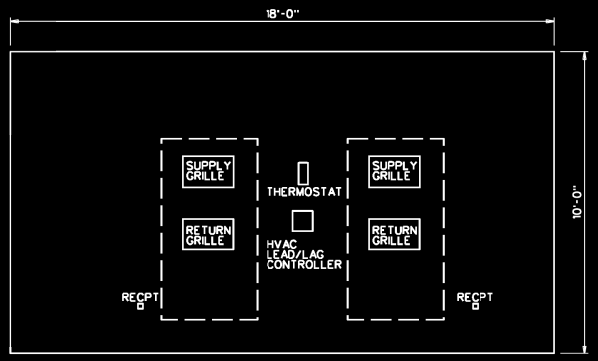


A/E006 ELEVATION NORTH WALL
NTS

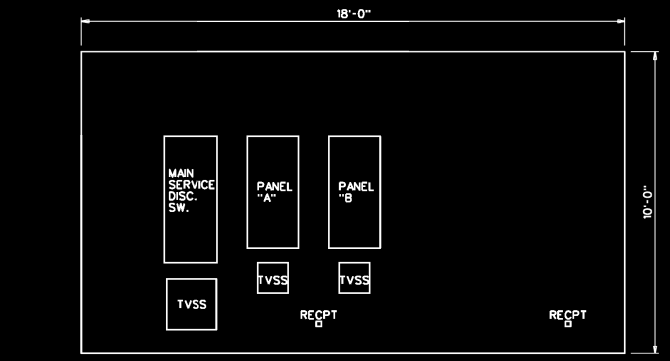
FIRE EXTINGUISHER



B/E006 ELEVATION SOUTH WALL
NTS



C/E006 ELEVATION WEST WALL
NTS



D/E006 ELEVATION EAST WALL
NTS

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REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

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FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR

SHELTER & DC BUS ELECTRICAL ELEVATIONS AND DETAILS

PUEBLO PUEBLO MEMORIAL AIRPORT CO

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PROJECT ENGINEER		MGR: ENGINEERING - SEATTLE
DESIGNED KH	ISSUED BY ENGINEERING SERVICES INFRASTRUCTURE	DATE JCN 991199
DRAWN KH		DRAWING NO PUB-D-RTR-E006 REV X
CHECKED		

ISSUED FOR CONSTRUCTION

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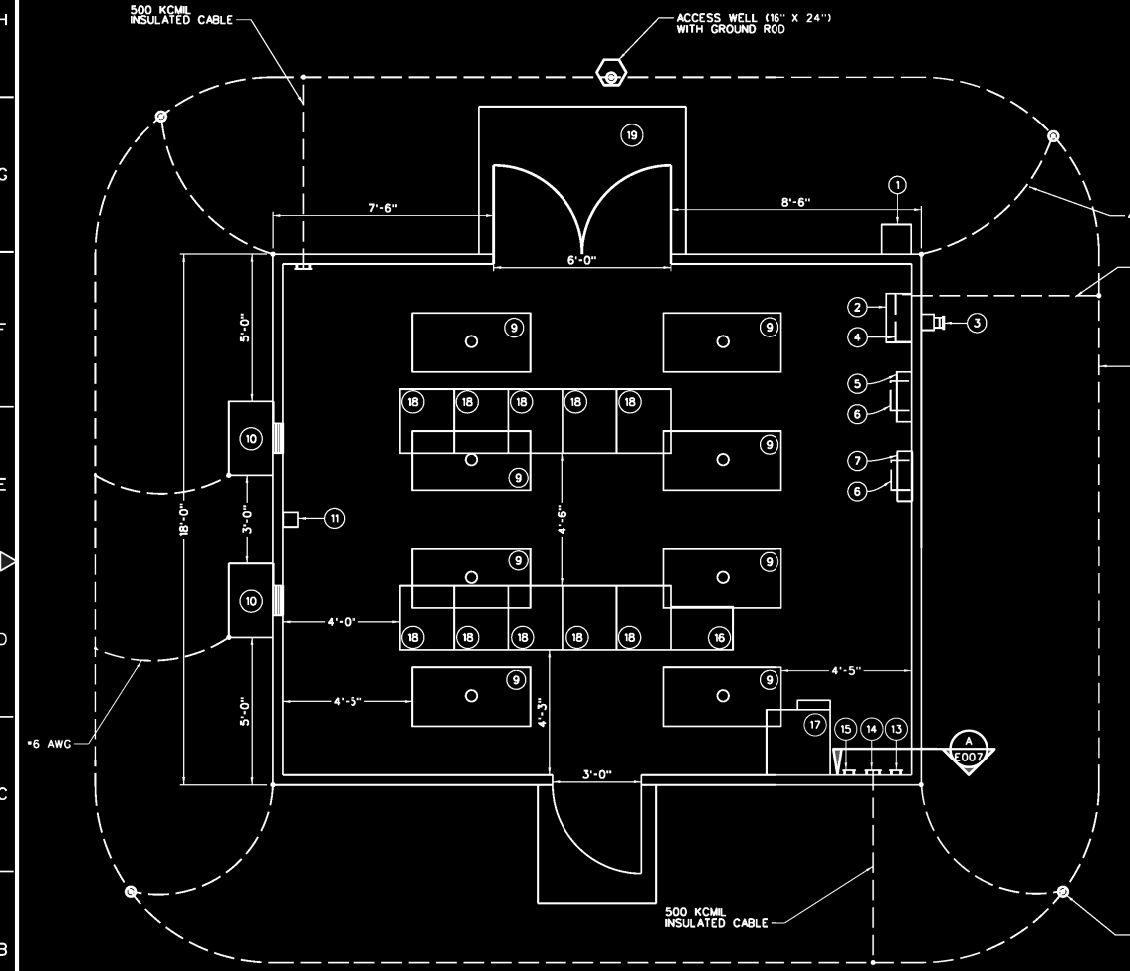


GROUNDING - COUNTERPOISE SYSTEM

SCALE: 1/2" = 1'-0"

GENERAL NOTES:

1) SEE DRAWING -E002 FOR ELECTRICAL FLOOR PLAN

2) ALL BONDING CONDUCTORS TO THE GROUND RING SHALL BE CONNECTED BY EXOTHERMIC WELDS.

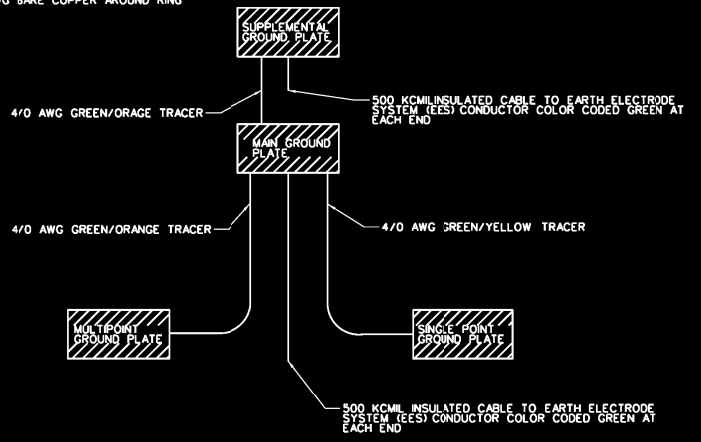
3) ALL MATERIAL IS CONTRACTOR PROVIDED UNLESS INDICATED AS GOVERNMENT FURNISHED (GFE).

4) MAIN GROUND PLATE SHALL BE COPPER AND 12" LONG, 6" WIDE AND 1/4" THICK. THE MAIN GROUND PLATE SHALL HAVE CLEAR PLASTIC COVER THAT BEARS THE CAPTION "MAIN GROUND PLATE" IN BLACK 3/8" HIGH LETTERS AND GREEN SLASHES AROUND THE CAPTION.

5) SUPPLEMENTAL GROUND PLATE SHALL BE COPPER AND 12" LONG, 6" WIDE AND 1/4" THICK. THE SUPPLEMENTAL GROUND PLATE SHALL HAVE CLEAR PLASTIC COVER THAT BEARS THE CAPTION "SUPPLEMENTAL GROUND PLATE" IN BLACK 3/8" HIGH LETTERS AND GREEN SLASHES AROUND THE CAPTION.

6) MUTIPOINT GROUND PLATE SHALL BE COPPER AND 12" LONG, 6" WIDE AND 1/4" THICK. THE MULTIPOINT GROUND PALTE SHALL HAVE CLEAR PALSTIC COVER THAT BEARS THE CAPTION "ELECTRONIC MULTIPOINT GROUND SYSTEM" IN BLACK 3/8" HIGH LETTERS WITH GREEN AND ORANGES SLASHES AROUND CAPTION.

7) SINGLE POIINT GROUND PALTE SHALL BE COPPER AND 12" LONG, 6" WIDE AND 1/4" THICK. THE SINGLE POINT GROUND PLATE SHALL HAVE CLEAR PLASTIC COVER THAT BEARS THE CAPTION " CAUTION, ELECTRONIC SINGLE POINT GROUND" IN BLACK 3/8" LETTERS WITH GREEN AND YELLOW SLASHES AROUND AROUND CAPTION.



A E007 GROUNDING PLATES DETAIL

NTS

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
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SHELTER & DC BUS ELECTRICAL GROUNDING PLAN

PUEBLO PUEBLO MEMORIAL AIRPORT CO

REVIEWED BY			
SUBMITTED	SIGN	APPROVED	SIGN
SUBMITTING ENGINEER	DO NOT SIGN	APPROVING ENGINEER	DO NOT SIGN
PROJECT ENGINEER		MGR: ENGINEERING - SEATTLE	
DESIGNED KN	ISSUED BY	DATE	JCN 991199
DRAWN KN	ENGINEERING SERVICES INFRASTRUCTURE	DRAWING NO	REV
CHECKED		PUB-D-RTR-E007	X

1' 0 1' 2' 5'
SCALE: 1/2" = 1'-0"

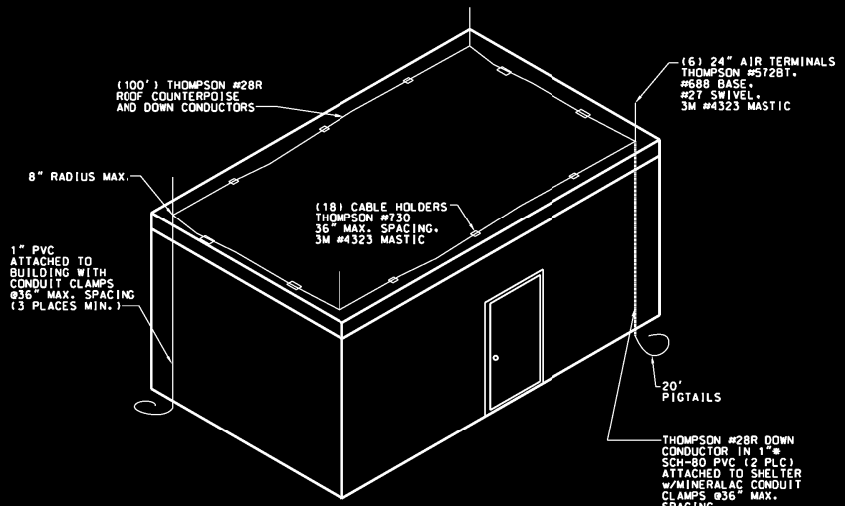
ISSUED FOR CONSTRUCTION

THIS DRAWING PRODUCED ON THE XXXXXXXXXX XGION MICROSTATION SYSTEM

ACTIVE

NOTES:

1. SEE DRAWINGS E007 FOR ELECTRICAL GROUNDING PLAN.
2. ALL BONDING CONDUCTORS TO THE GROUND RING SHELL BE CONNECTED BY EXOTHERMIC WELDS.
3. ALL BONDING WORK IS NEW UNLESS SHOWN AS EXISTING.
4. ALL MATERIAL ARE CONTRACTOR PROVIDED UNLESS INDICATED AS GOVERNMENT FURNISHED.



LIGHTNING PROTECTION DETAIL

N.T.S.

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PUBLIC AVAILABILITY TO BE DETERMINED UNDER 5 USC 552

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
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SHELTER & DC BUS
ELECTRICAL
LIGHTNING PROTECTION DETAIL

PUEBLO PUEBLO MEMORIAL AIRPORT CO

REVIEWED BY	SUBMITTED	APPROVED
	DO NOT SIGN	DO NOT SIGN
PROJECT ENGINEER		MGR: ENGINEERING - SEATTLE
DESIGNED KH	ISSUED BY	DATE JCN 991199
DRAWN KH	ENGINEERING SERVICES INFRASTRUCTURE	DRAWING NO PUB-D-RTR-E008 REV X
CHECKED		

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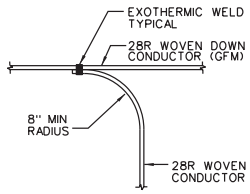
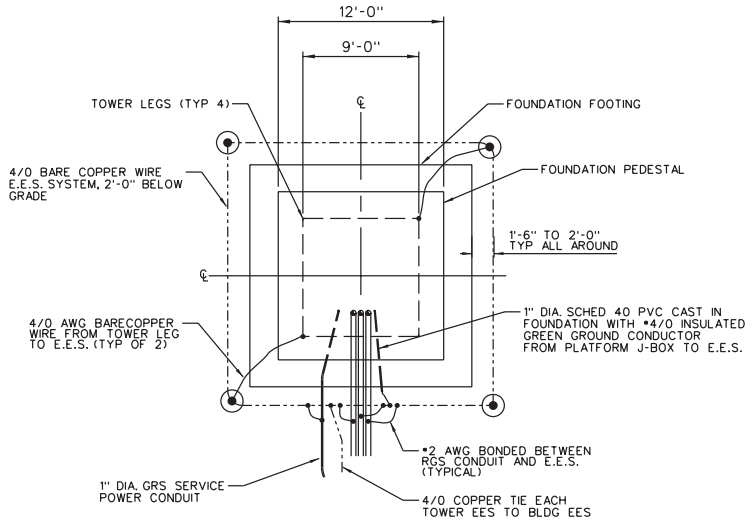
ACTIVE



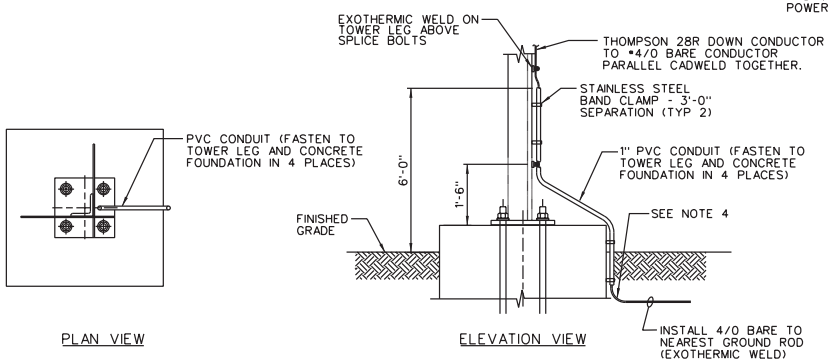
A E005 TYP CONDUCTOR CONNECTION DETAIL
NOT TO SCALE



C E005 TOWER FOUNDATION GROUNDING DETAIL
NOT TO SCALE

NOTES:

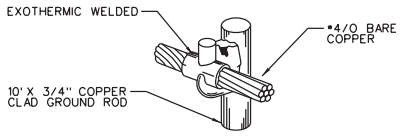
1. GRIND STEEL FREE OF ANY PAINT OR PROTECTIVE COATING BEFORE MAKING ANY GROUNDING CONNECTIONS. UPON COMPLETION OF CONNECTION, RE-GALVANIZE UNPROTECTED AREAS WITH COLD GALVANIZING PAINT.
2. ALL LIGHTNING PROTECTION EQUIPMENT SHALL BE UL LISTED FOR THIS USE.
3. CONDUIT BENDS SHALL HAVE A MINIMUM BEND RADIUS AS REQUIRED REQUIRED BY THE NEC. CONDUCTOR BEND RADIUS SHALL NOT BE LESS THAN 8 TIMES CABLE OUTSIDE DIA.METER.
4. SEAL ALL PVC CONDUITS USED TO PROTECT GROUND WIRES WATER TIGHT.
5. HALO RING:
   CONTRACTOR SHALL INSTALL 28R WOVEN DOWN CONDUCTOR HORIZONTALLY AROUND THE BASE OF THE VERTICAL FACE OF THE PLATFORM TOWER. EXOTERMICALLY ATTACH EVERY 3-FEET. FROM THIS TOWER PLATFORM HALO RING, ATTACH A VERTICAL DOWN CONDUCTOR ON DIA.GONAL OPPOSITE LEGS OF THE TOWER AND ROUTE TO THE BURIED E.E.S. CLAMP CONDUCTORS EVERY 3-FEET TO LEGS OF TOWER.
6. N/A
7. CONTRACTOR SHALL FURNISH AND INSTALL #4/0 BARE COPPER WIRE TO DIA.GONAL OPPOSITE LEGS OF THE TOWER BASE. EXOTHERMICALLY ATTACH TO THE TOWER LEGS AND ROUTE TO THE NEAREST BURIED ESS GROUND ROD.



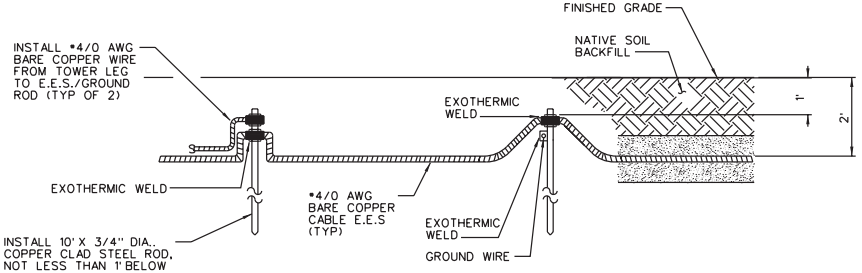
B E005 TOWER DOWN CONDUCTOR GROUNDING DETAIL
NOT TO SCALE

LEGEND:

- 10' X 3/4" DIA. COPPER CLAD GROUND ROD (TYP OF 4)
- 2AWG EXOTHERMICALLY WELDED TO RGS CONDUIT AND E.E.S
- EXOTHERMIC WELD



E E005 GROUND ROD CONNECTION DETAIL
NOT TO SCALE



D E005 GROUND ROD/E.E.S. INSTALLATION DETAIL
NOT TO SCALE

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

RTR ANTENNA TOWERS GROUNDING DETAILS

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED BY	APPROVED BY

DESIGNED	ISSUED BY	DATE	JCN
DRAWN		DRAWING NO.	REV
CHECKED		PUB-D-RTR-E009	

ISSUED FOR:

EDMS pub-d-rtr-e009.dgn

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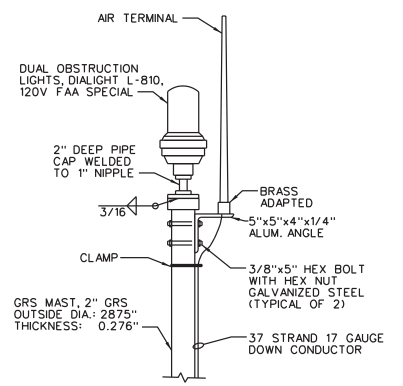
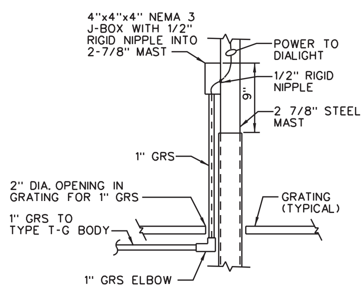
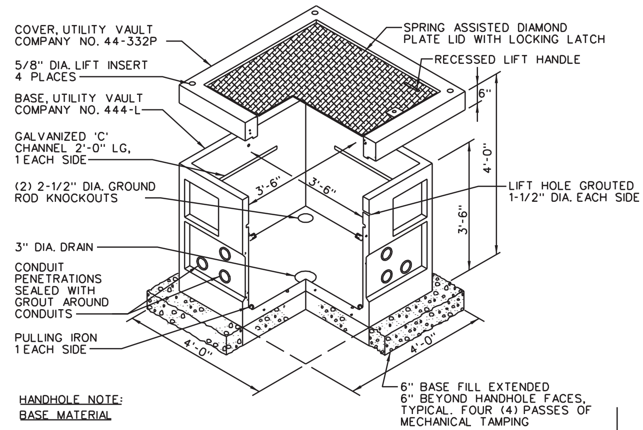

AIR TERMINAL
DUAL OBSTRUCTION LIGHTS, DIALIGHT L-810, 120V FAA SPECIAL
2" DEEP PIPE CAP WELDED TO 1" NIPPLE
3/16
BRASS ADAPTED
5"x5"x4"x1/4" ALUM. ANGLE
CLAMP
3/8"x5" HEX BOLT WITH HEX NUT GALVANIZED STEEL (TYPICAL OF 2)
GRS MAST, 2" GRS OUTSIDE DIA.: 2875" THICKNESS: 0.276"
37 STRAND 17 GAUGE DOWN CONDUCTOR



DUAL OBSTRUCTION LIGHT AND AIR TERMINAL DETAILS

SCALE: 1 1/2"=1'-0"


COVER, UTILITY VAULT COMPANY NO. 44-332P
5/8" DIA. LIFT INSERT 4 PLACES
BASE, UTILITY VAULT COMPANY NO. 444-L
GALVANIZED 'C' CHANNEL 2'-0" LG, 1 EACH SIDE
(2) 2-1/2" DIA. GROUND ROD KNOCKOUTS
3" DIA. DRAIN
CONDUIT PENETRATIONS SEALED WITH GROUT AROUND CONDUITS
PULLING IRON 1 EACH SIDE
SPRING ASSISTED DIAMOND PLATE LID WITH LOCKING LATCH
RECESSED LIFT HANDLE
6"
4'-0"
3'-6"
3'-6"
3'-6"
LIFT HOLE GROUTED 1-1/2" DIA. EACH SIDE
4'-0"
4'-0"
6" BASE FILL EXTENDED 6" BEYOND HANDHOLE FACES, TYPICAL. FOUR (4) PASSES OF MECHANICAL TAMPING

HANDHOLE NOTE:
BASE MATERIAL

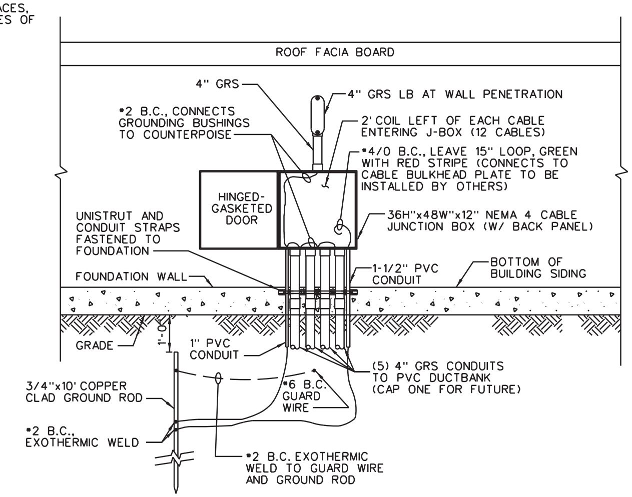
BENEATH HANDHOLE AND IN ACCORDANCE WITH ASTMD D 2487, CLASSIFICATION GW, GP, SW, SP WITH A MAXIMUM 10% PASSING ASTM D 1140 NO. 4 SIEVE.

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/2 INCH	100
1 INCH	95-100
1/2 INCH	25-60
NO. 4	10 MAX.

ISOMETRIC VIEW

H-20 LOADING HANDHOLE

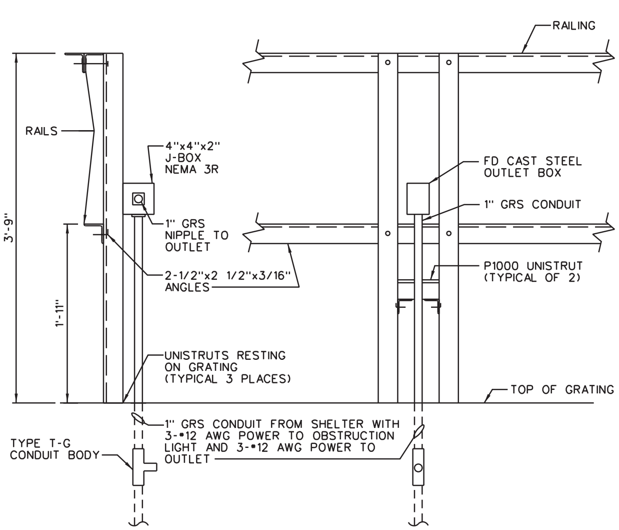
NOT TO SCALE


ROOF FACIA BOARD
4" GRS
4" GRS LB AT WALL PENETRATION
•2 B.C., CONNECTS GROUNDING BUSHINGS TO COUNTERPOISE
2' COIL LEFT OF EACH CABLE ENTERING J-BOX (12 CABLES)
•4/0 B.C., LEAVE 15" LOOP, GREEN WITH RED STRIPE (CONNECTS TO CABLE BULKHEAD PLATE TO BE INSTALLED BY OTHERS)
HINGED-GASKETED DOOR
36H"x48W"x12" NEMA 4 CABLE JUNCTION BOX (W/ BACK PANEL)
UNISTRUT AND CONDUIT STRAPS FASTENED TO FOUNDATION
FOUNDATION WALL
1-1/2" PVC CONDUIT
BOTTOM OF BUILDING SIDING
GRADE
1'-0"
1" PVC CONDUIT
(5) 4" GRS CONDUITS TO PVC DUCTBANK (CAP ONE FOR FUTURE)
3/4"x10' COPPER CLAD GROUND ROD
•6 B.C. GUARD WIRE
•2 B.C., EXOTHERMIC WELD
•2 B.C. EXOTHERMIC WELD TO GUARD WIRE AND GROUND ROD

(MOUNTED ON OUTSIDE SHELTER WALL)

COAXIAL CABLE JUNCTION BOX

NOT TO SCALE

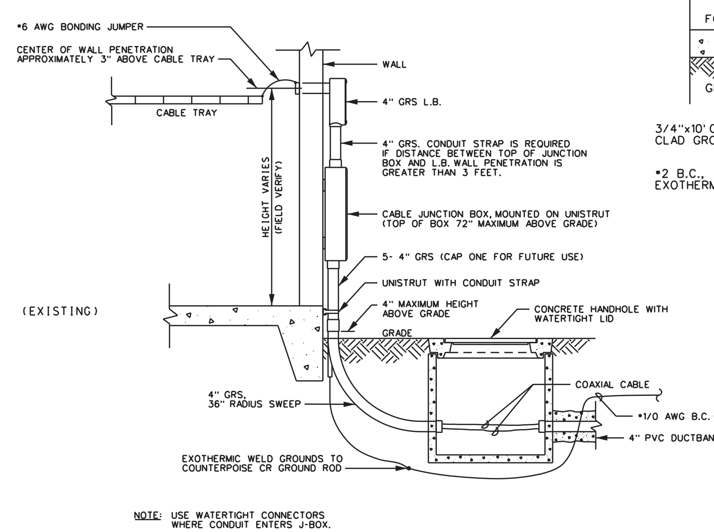

RAILS
3'-9"
1'-11"
4"x4"x2" J-BOX NEMA 3R
1" GRS NIPPLE TO OUTLET
2-1/2"x2 1/2"x3/16" ANGLES
UNISTRUTS RESTING ON GRATING (TYPICAL 3 PLACES)
TYPE T-G CONDUIT BODY
1" GRS CONDUIT FROM SHELTER WITH 3-•12 AWG POWER TO OBSTRUCTION LIGHT AND 3-•12 AWG POWER TO OUTLET
RAILING
FD CAST STEEL OUTLET BOX
1" GRS CONDUIT
P1000 UNISTRUT (TYPICAL OF 2)
TOP OF GRATING

SIDE ELEVATION

FRONT ELEVATION

OUTLET DETAIL

SCALE: 1 1/2"=1'-0"


•6 AWG BONDING JUMPER
CENTER OF WALL PENETRATION APPROXIMATELY 3" ABOVE CABLE TRAY
CABLE TRAY
WALL
4" GRS L.B.
HEIGHT VARIES (FIELD VERIFY)
4" GRS. CONDUIT STRAP IS REQUIRED IF DISTANCE BETWEEN TOP OF JUNCTION BOX AND L.B. WALL PENETRATION IS GREATER THAN 3 FEET.
CABLE JUNCTION BOX, MOUNTED ON UNISTRUT (TOP OF BOX 72" MAXIMUM ABOVE GRADE)
5- 4" GRS (CAP ONE FOR FUTURE USE)
UNISTRUT WITH CONDUIT STRAP
(EXISTING)
4" MAXIMUM HEIGHT ABOVE GRADE
GRADE
CONCRETE HANDHOLE WITH WATERTIGHT LID
COAXIAL CABLE
4" GRS, 36" RADIUS SWEEP
•1/0 AWG B.C. GROUND
4" PVC DUCTBANK
EXOTHERMIC WELD GROUNDS TO COUNTERPOISE CR GROUND ROD

NOTE: USE WATERTIGHT CONNECTORS WHERE CONDUIT ENTERS J-BOX.

CABLE JUNCTION BOX AT SHELTER

(WITH HANDHOLE)

SCALE: 1/2" = 1'-0"

1' 9" 6" 3" 0 1'

SCALE: 1 1/2" = 1'-0"

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

RTR TOWER ELECTRICAL DETAILS
JUNCTION BOX AND HANDHOLE DETAILS

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY | SUBMITTED BY | APPROVED BY

DESIGNED | ISSUED BY | DATE | JCN

DRAWN | DRAWING NO PUB-D-RTR-E010 | REV

CHECKED

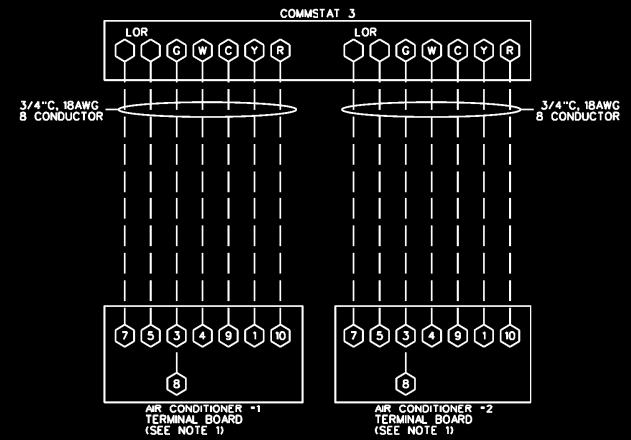
ISSUED FOR:

AIR CONDITIONER UNIT SCHEDULE

EQUIP NUMBER	SERVICE	MANUFACTURER/ MODEL	REFRIGERANT	DSCHARGE	COMBINED COOLING CAPACITY (BTU/HR)		DESIGN COOLING CAPACITY (BTU/HR)		DESIGN TEMP		GRILLE SIZE AND FILTER DATA			ELECTRICAL CHARACTERISTICS												REMARKS
														ELECTRICAL RATING	COMPRESSER			OUTDOOR FAN MOTOR				INDOOR FAN MOTOR				
					TOTAL	SENSIBLE	TOTAL	SENSIBLE	COND ENT DB	EVAP ENT DB/ WB	SUPPLY	RETURN	FILTER	NOMINAL INPUT	MCA	MFS	NOMINAL INPUT	RLA	LRA	MCC	NOMINAL INPUT	RPM	FLA	MCC	NOMINAL INPUT	RPM	FLA	MCC	
HVAC-1 HVAC-2	EQUIP. ROOM	MARVAIR/ AVPA48ACA MARVAIR/ AVPA48ACA	R-410A	HORIZONTAL SUPPLY GRILL)	44,000	35,125	36,000	36,000	79	75/ 59	20X8	20X12	16X25X2	208V 1 PHASE 60 HZ	27.4	30	208V 1 PHASE 60 HZ	21.1	96	33	208V 1 PHASE 60 HZ	825	2.8	1/3	208V 1 PHASE 60 HZ	1075	3.1	1/2	OPTIONS: 1. ECONOMIZER 2. MINIMUM POSITION POTENTIOMETER 3. DIRTY FILTER INDICATOR 4. 6KW ELECTRIC HEAT 5. DRY BULB SENSOR 6. LEAD/LAG CONTROLLER (COMMSTAT 3) 7. COATED COIL 8. TELECOM CONTROLS PACKAGE (INCLUDING LOW AMBIENT) 9. COLD CLIMATE PACKAGE

SEQUENCE OF OPERATION (EQUIPMENT ROOM)

1. THE HVAC UNITS ARE REDUNDANT AND SHALL OPERATE IN A DUTY/STANDBY CONFIGURATION.
2. DUTY/STANDBY STATUS IS AUTOMATICALLY SWITCHED OVER BY A CONTROLLER.
3. THE AIR CONDITIONING SETPOINT IS 77°F. THE HEATING SETPOINT IS 72°F.
4. THE FIRST STAGE OF COOLING IS FROM THE HVAC UNIT'S ECONOMIZER. FRESH AIR IS MIXED WITH THE RETURN AIR TO TRY AND MAINTAIN 50-56°F AIR.
5. THE SECOND STAGE OF COOLING IS PROVIDED BY THE DUTY UNIT.
6. THE STANDBY UNIT ACTIVATES WHEN THE DUTY UNIT FAILS OR IS UNABLE TO MAINTAIN THE SPACE TEMPERATURE.



A/C CONTROLLER WIRING DIAGRAM
NOT TO SCALE

NOTES

1. FOR IMMEDIATE SHUTDOWN OF AIR CONDITIONER UPON A SMOKE SIGNAL, REMOVE THE JUMPER BETWEEN TERMINAL 8 AND 10 AND PLACE A JUMPER BETWEEN TERMINALS 8 AND 3.
2. 24VAC CONNECTIONS ONLY.

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REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD
D					
C					
B					
A					

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR
SHELTER & DC BUS
MECHANCIAL
AIR CONDITIONER SCHEDULES

PUEBLO PUEBLO MEMORIAL AIRPORT CO

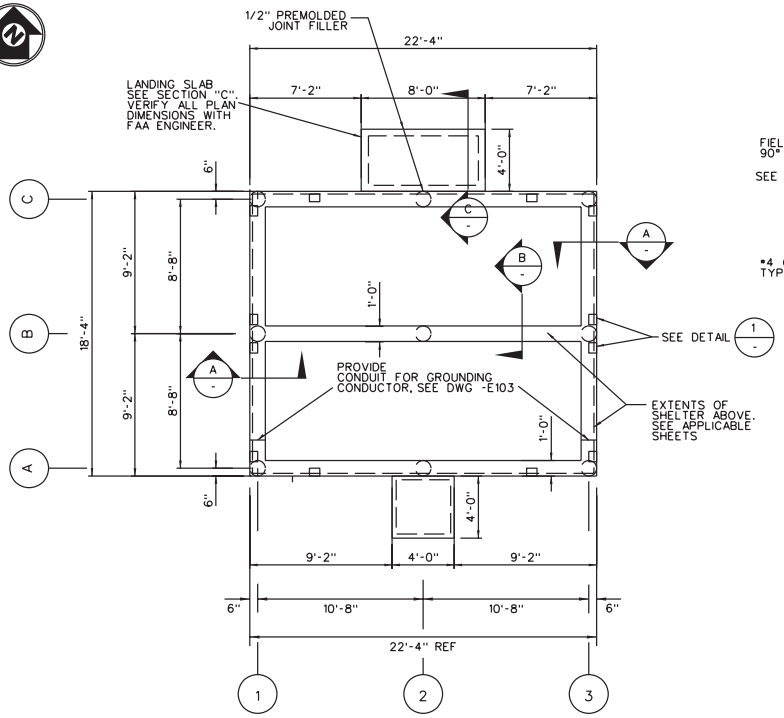
REVIEWED BY	SUBMITTED	APPROVED
	DO NOT SIGN	DO NOT SIGN
PROJECT ENGINEER		MGR: ENGINEERING - SEATTLE
DESIGNED	ISSUED BY	DATE / JCN 991199
DRAWN	ENGINEERING SERVICES INFRASTRUCTURE	DRAWING NO / REV PUB-D-RTR-M001 X
CHECKED		

ISSUED FOR CONSTRUCTION 20090909090

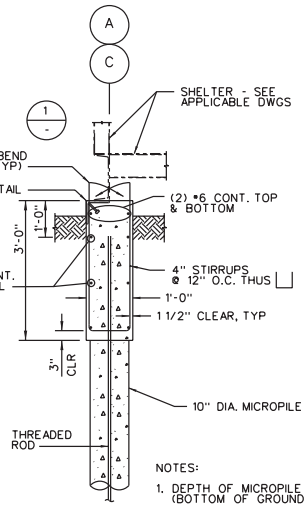
THIS DRAWING PRODUCED ON THE XXXXXXXXXX ICGION MICROSTATION SYSTEM

ACTIVE

pub-d-rtr-m001.dgn
2/10/2010 10:34:54 PM kevin.d.rogers

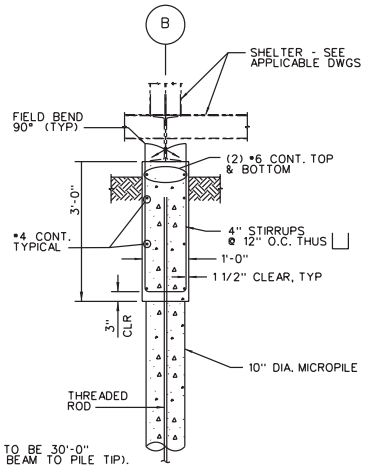


FOUNDATION PLAN
SCALE: 1/4" = 1'-0"

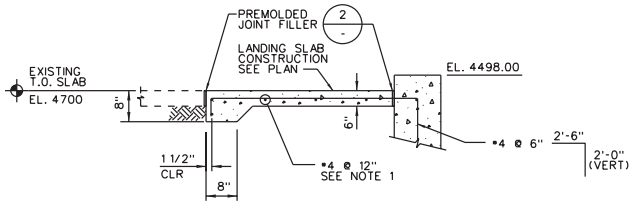


NOTES:
1. DEPTH OF MICROPILE TO BE 30'-0" (BOTTOM OF GROUND BEAM TO PILE TIP).
2. CORNER REINF.: #4 & #6, SEE NOTE 2.

A SECTION
SCALE: 3/4" = 1'-0"

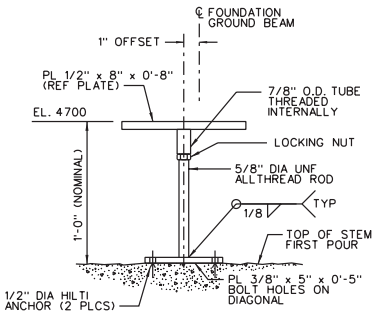


B SECTION
SCALE: 3/4" = 1'-0"



C SECTION
SCALE: 3/4" = 1'-0"

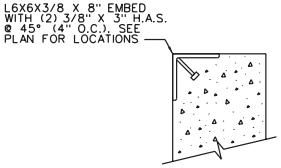
NOTES:
1. LANDING SLAB CONSTRUCTION: 6" CONCRETE SLAB OVER UNDISTURBED NATIVE MATERIAL OR COMPACTED STRUCTURAL FILL (SEE GEOTECHNICAL REPORT). REINFORCE SLAB WITH #4 @ 12" O.C., EACH WAY AT MID-DEPTH. PROVIDE NO CONTROL JOINTS.
2. IT IS ESSENTIAL TO ENSURE ACCURATE VERTICAL CONTROL OF THE ELEVATION OF THE BUILDING FOUNDATION GRADE BEAMS. NO TOLERANCE ON THIS ELEVATION IS PERMITTED. TOP OF CONCRETE IS AT EL. 4700. AFTER INSTALLATION OF THE BUILDING SUPERSTRUCTURE THE BASE FRAME SHALL BE FIELD WELDED TO THE EMBEDDED LEVELING PLATES, ALONG THE EXTERIOR GRADE BEAMS BY THE BUILDING MANUFACTURER/INSTALLER.
3. REFER TO THE SOILS REPORT BY KLEINFELDER, ESTIMATED DATE AVAILABLE MARCH 15, 2012
4. COMPACTED FILL EXTENDS 12" BEYOND THE FOOTING PERIMETER. THE COMPACTION FOR THE FIRST 12" IS 90% AND FOR THE LAST 6", THE COMPACTION IS 95%. AT A MINIMUM, THE FILL MATERIAL SHALL CONSIST OF MINUS 3" AGGREGATE WELL GRADED SANDY GRAVEL WITH BETWEEN 5 AND 15% PASSING THE NO. 200 SIEVE.



(FABRICATE 14 TOTAL)

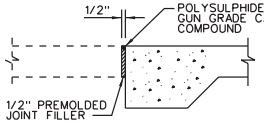
NOTES:
1. ALL MATERIAL: A36 STEEL
2. SET ASSEMBLY VERTICALLY PLUMB IN FORMS.
3. SEE NOTE 2, INSTALLATION.

1 DETAIL
SCALE: 3" = 1'-0"



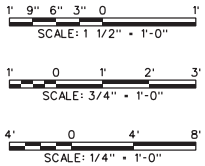
(TYPICAL 12 PLACES)

1 DETAIL
SCALE: 1 1/2" = 1'-0"



(TYPICAL 2 PLACES)

2 DETAIL
SCALE: 1 1/2" = 1'-0"



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REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATO - TECHNICAL OPERATIONS WESTERN SERVICE AREA

RTR
PUEBLO RTR
SHELTER
FOUNDATION PLAN & SECTIONS

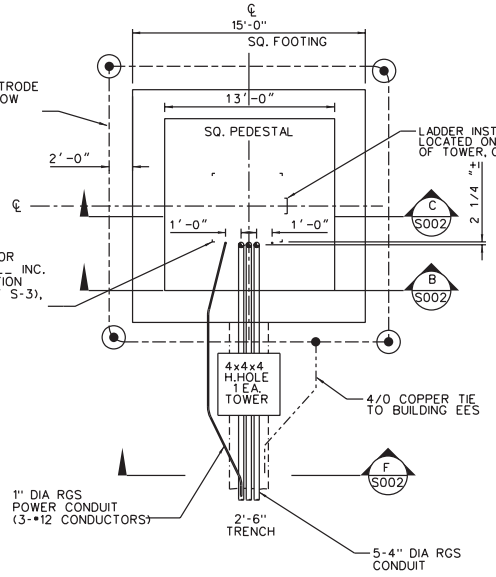
PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED	APPROVED
	$WATERMARK$	$WATERMARK$
PROJECT ENGINEER		MGR: CONSTRUCTION - SEATTLE
DESIGNED	ISSUED BY	DATE / JCN
DRAWN RWK	ENGINEERING SERVICES COMMUNICATIONS	DRAWING NO: PUB-D-RTR-S001
CHECKED		REV

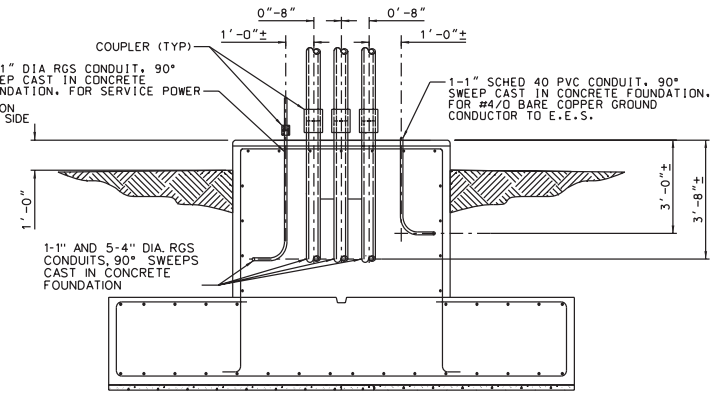
ISSUED FOR CONSTRUCTION

DRAWING PRODUCED ON WSA MICROSTATION SYSTEM

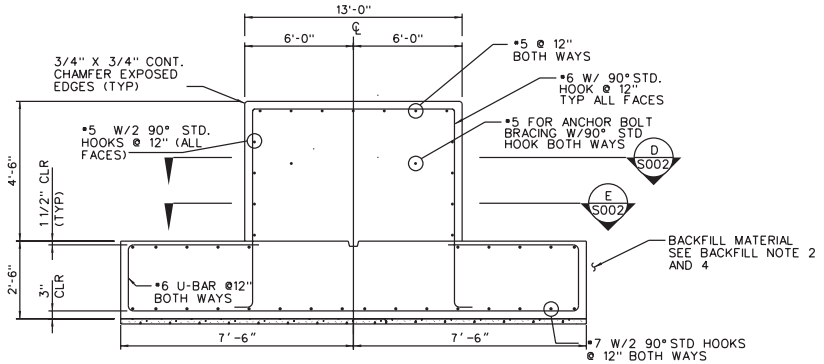
BRAKES STINES BRAKES



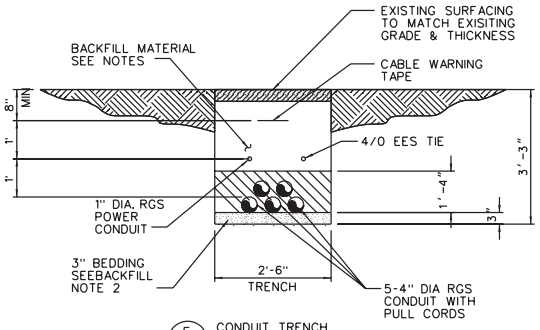
A S002 PLAN VIEW
SCALE: 1/4" = 1'-0"



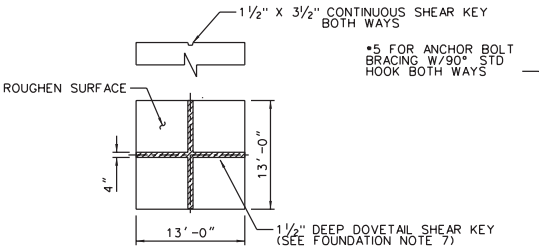
B S002 FOUNDATION ELEVATION
NOT TO SCALE



C S002 FOUNDATION ELEVATION
NOT TO SCALE



F S002 CONDUIT TRENCH
NOT TO SCALE



E S002 SHEAR KEY DETAIL SECTION
NOT TO SCALE

D S002 ANCHOR BOLT REINFORCEMENT PLAN
NOT TO SCALE

NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AFFECTING THE WORK AT THE JOB SITE.
2. FOR LOCATION AND DIMENSIONS OF SLEEVE OPENINGS, EMBEDDED ITEMS; REFER TO STRUCTURAL, ELECTRICAL, AND APPROVED SHOP DRAWINGS.

FOUNDATIONS:

1. FOUNDATION DESIGN IS IN ACCORDANCE WITH THE REQUIREMENTS OF THE GEOTECHNICAL REPORT BY KLEINFELDER, INC TO BE AVAILABLE MARCH 15 2012 (ESTIMATED DATE)
2. CONSTRUCTION OF ALL CONCRETE WORK SHALL CONFORM TO ACI-318
3. MINIMUM ALLOWANCE FOR SOIL BEARING PRESSURE - 2,500 PSF.
4. THE BASE OF THE PAD FOUNDATION SHALL BE PLACED AT A MINIMUM DEPTH OF 3'-0".
5. DURING EXCAVATION OF THE FOUNDATION, THE DEPTH OF FILL MAY BE FOUND TO BE DIFFERENT THAN WAS ESTIMATED BASED ON THE NEARBY BORINGS. THE PAD FOUNDATION SHALL BE PLACED ON UNDISTURBED NATIVE SANDY CLAY SOIL OR ENGINEERED CONTROLLED COMPACTED FILL.
6. ANCHOR BOLTS (GFM) SHALL BE ACCURATELY PLACED, ADEQUATELY SUPPORTED, AND SECURED AGAINST DISPLACEMENT. A REGISTERED LAND SURVEYOR SHALL VERIFY THE LOCATION AND ELEVATION OF ANCHOR BOLTS PRIOR TO CONCRETE PLACEMENT.
7. WITH THE APPROVAL OF THE PROJECT ENGINEER, THE TOWER FOUNDATION FOOTING MAY BE CAST SEPARATELY FROM THE PIER. IF PIER IS CAST SEPARATELY, A BONDING AGENT, ROUGHENING OF FOOTING SURFACE AND SHEAR KEY AS SHOWN SHALL BE USED. NO OTHER JOINTS ARE ALLOWED IN THE TOWER FOUNDATION.

CONCRETE:

1. CONCRETE SHALL HAVE A MINIMUM 28 DAY CYLINDER COMPRESSION STRENGTH OF 4000 PSI. ALL CONCRETE SHALL BE AIR ENTRAINED. ALL CONCRETE SHALL BE CURED.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS CONFORMING TO ASTM A615 GRADE 60.
3. MINIMUM CONCRETE PROTECTION, SPLICES, AND HOOKS FOR REINFORCING STEEL SHALL CONFORM TO AMERICAN CONCRETE INSTITUTE (ACI) 318.
4. ALL REINFORCEMENT MARKED CONTINUOUS SHALL BE PROPERLY LAPPED AT SPLICES, CORNERS, AND HOOKED AT NON -CONTINUOUS ENDS.

BACKFILL:

1. BACK FILL WITH SUITABLE EXCAVATED MATERIAL, I.E. NO STONE AGGREGATES LARGER THAN 4" DIA OR ORGANIC
2. MATERIAL. COMPACT IN THREE LIFTS; EACH LIFT TO RECEIVE THREE PASSES WITH HAND COMPACTOR. RESTORE SURFACE TO MATCH EXISTING. REMOVE ANY EXCESS EXCAVATED MATERIALS.
3. BEDDING MATERIAL SHALL CONTAIN NO MATERIAL THAT WOULD BE RETAINED IN A ONE INCH SIEVE. TAMP BEDDING MATERIAL UNTIL FIRM.
4. COMPACT AND BACK FILL SUBGRADE IN ACCORDANCE WITH SECTION TX, COLORADO DOT STRUCTURAL BACK FILL (CLASS 1).

UTILITY LINES:

1. CROSSING AN EXISTING UTILITY LINE:
   A. UTILITY LINE BELOW NEW 4 INCH RGS CONDUIT- PROVIDE 1-FOOT VERTICAL SEPARATION AND BACK FILL BASE MATERIAL AS DESCRIBED IN NOTE 2.
   B. UTILITY LINE ABOVE NEW 4 INCH RGS CONDUIT- PROVIDE 1-FOOT VERTICAL SEPARATION AND BACK FILL ABOVE NEW CONDUIT.

REV	APPROVED DATE	DESCRIPTION	JCN	REDLINE DATE	APVD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

RTR

RTR ANTENNA TOWERS
FOUNDATION & TRENCH DETAILS

PUEBLO — PUEBLO MEMORIAL AIRPORT — CO

REVIEWED BY	SUBMITTED	APPROVED	
	DESIGNED	ISSUED BY	DATE JCN
	DRAWN		DRAWING NO PUB-D-RTR-S002 REV
	CHECKED		

ISSUED FOR:

SPLICES SHOWN STAGGERED